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Art. IX.—*New or Little-known Fossils in the National Museum.*

Part XXVII.—Some Cainozoic Fish Remains, with a Revision of the Group.

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and

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(With Plates IX.-XI.)

[Read 8th November, 1923.]

Introduction.

Three papers on the Tertiary Fish remains of Australia have already been published, two by F. Chapman and G. B. Pritchard, and a third by F. Chapman, in the years 1904, 1907, and 1917 respectively. Since the latter date, much new material has been acquired by the National Museum, and thus it was considered that the time was opportune to present a resumé and description up to date, of the entire collection, as far as the material will allow.

The synopsis that we furnish at the end of this paper will show that the Australian Cainozoics contain much material of the greatest interest in regard to fossil ichthyology. At the same time it will afford some interesting data in regard to the earlier history of the living Australian fish fauna. It will be seen that the principal genera of the living Australian sharks are represented in the Cainozoic system as far back as Upper Miocene times, probably having at least an antiquity of two million years. Several genera, indeed, are pushed back in their history to at least three or four million years. These are the Grey and the Blue Nurse sharks (*Carcharias*), the Hammerheaded shark (*Sphyrna*), the Bull-dog shark (*Odontaspis*), the Blue Pointer sharks (*Lamna* and *Isurus*) and the Great White shark (*Carcharodon*). The latter in Miocene times reached its acme of gigantism, for the teeth that are found in the Miocene of Eastern and Western Victoria indicate a fish which must have attained a length of nearly a hundred feet.

The occurrence of the genus *Strophodus*, which was first recognised by Professor Ralph Tate from our Australian Tertiaries, is of more than particular interest, for the genus as identified by teeth only (see note *infra* in description of *Strophodus*) is, in the northern hemisphere, represented by species which range from the Middle Jurassic to the lower part of the Upper Cretaceous, whilst

here it seems to be confined to the Miocene and possibly Lower Pliocene.

In the genus *Cestracion* we have in common with some other genera of fossils a remarkable instance where marine organisms have been established in the northern hemisphere until a certain period and have then migrated to the southern hemisphere where they now form part of the characteristic fauna. The genus *Cestracion*, as a northern fossil, is noted as late as the Lower Eocene in England and the Middle Eocene in Belgium. In Australia and New Zealand, this shark evidently existed in some abundance in Miocene times and we also include Patagonia, since Ameghino's *Acrodus* is apparently the same generic form. The latter practically belongs to the Miocene period, and in Australia *Cestracion* extended upwards into Pliocene times. The living species is now found in abundance round the Australian coast (*C. philippi.*)

Amongst the new records we have noted several species of fossil fish which have hitherto been confined to New Zealand Cainozoic deposits. These are *Cestracion coleridgensis*, *C. novozelandicus*, and *Carcharias aculeatus*.

Of previously ultra-Australian records we now include the North American *Carcharias collata* and *C. incidens*, the Javan *Carcharias javanus*, the European and Patagonian *Odontaspis rutoti*, and *Hemipristis serra*, the latter being already known from Europe, North America, Patagonia and Java.

The list of new species suggests some noteworthy comments; and, incidentally, indicates the utility of having access to larger collections than hitherto, so that one can judge more clearly as to the limitations of species. Thus *Cestracion longidens* appears to be a good and distinct form and is one which was earlier associated with the better known *C. cainozoicus*. Quite a number of species of the genus *Carcharias* have now been established for the Australian Cainozoics, and one of them, here named *C. victoriae*, is a small form with some of the characters of *C. magna* of Maryland, U.S.A., and this species may prove useful for correlation purposes. In addition to the already described fossil species of the Saw Fish, we here record as new, *Pristis recurvidens*, a Miocene to Lower Pliocene form, from Table Cape, Tasmania, Murray River Cliffs, South Australia, and Beaumaris, Victoria. In *Myliobatis affinis* we have a slenderer and more finely denticulated type of palatal tooth which is separable on these grounds from the Kalimnan *M. moorabbinensis*. The specimens previously referred to this latter species from the Mallee Bores are now transferred to *M. affinis*. Continued research amongst the Batesford beds will probably yield still further interesting fish remains, for we here describe two notable additions from that locality, namely, a spine of an extinct *Myliobatis* of stronger ornament than that of the living Eagle Ray and also an interesting form of the genus *Labrodon* in which the teeth are beautifully preserved.

The occurrence of a tooth of an extinct species of Angel-fish (*Squatina*) from Gippsland is, so far, the sole record of this genus in the Tertiaries of the Australian area.

We have taken the opportunity to figure additional specimens of the characteristic Chimaeroid *Edaphodon*, which is so typical of the fish remains of the remanié beds of Grange Burn and Beaumaris. Another and most remarkable species of the genus is now described as *E. mirabilis*. This appears to represent the final stage of the genus before its extinction, since it is probably the largest known form and is quite the latest geological record of any *Edaphodon*. A further proof that many of the well-known Australian fishes living round the coast were well established in Miocene times is furnished by the occurrence of a spine of the Cow-fish, *Aracana kershawi*, in the lower beds of Table Cape, Tasmania.

The total number of genera of Cainozoic fishes now known, to the date of this paper, is twenty-eight. The number of species amounts to fifty-nine; of these, there are ten new to science.

Description of Species.

Order PLAGIOSTOMI, Duméril (Sharks and Rays).

Family NOTIDANIDAE, Bonaparte.

Genus **Notidanus**, Cuvier. (Grey sharks.)

NOTIDANUS JENNINGSI, Chapman and Pritchard.

Notidanus jenningsi, Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 268, pl. XI., fig. 1, 2 Chapman, 1914, Australasian Fossils, p. 270.

Observations.—There has been no fresh occurrence of this species.

Family SPINACIDAE, Müller and Henle.

Genus **Acanthias**, Risso. (Spiny Dog-fishes.)

ACANTHIAS GEELONGENSIS, Chapman and Pritchard.
(Plate IX. fig. 1.)

Acanthias geelongensis, Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 269, pl. XI., fig. 15. Chapman, 1914, Australasian Fossils, p. 270.

Observations.—It is interesting to record another occurrence for this rare form, which has already been found in the Fyansford beds at Orphanage Hill, near Geelong. This later formation we regard as an argillaceous phase of the Janjukian. The present occurrence is in the typical Janjukian locality of Bird Rock Cliffs, Torquay. The specimen agrees very closely with the one previously figured and described. The only difference noticed is in the slightly more elevated character of the crown.

Additional occurrence.—Janjukian. From the "Ledge," Bird Rock Cliffs, near Torquay (Nat. Mus. Coll., pres. from the T. S. Hall Coll. by F. A. Cudmore).

Family CESTRACIONTIDAE, Agassiz.

Genus **Cestracion**, Cuvier. (Port Jackson shark.)

Cestracion cainozoicus Chapman and Pritchard.

(Plate IX., figs. 2-7.)

Cestracion cainozoicus, Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 270, pl. XI., figs. 5-8; pl. XII., fig. 2. Chapman, 1914, Australasian Fossils, pp. 269, 271, 307.

Observations.—In addition to the descriptive remarks given by the above authors, we may note the great variation in the size of the teeth of this, the commonest of the Australian species. A notable distinctive feature of *C. cainozoicus* when compared with the species subsequently referred to, is the solidity and thickness of the tooth. In one or two cases in the Table Cape occurrence we note examples of the rhomboidal and sub-tabulate teeth of the anterior series which cover the interior side of the lower jaw. The upper surface of the teeth, belonging to the median lateral series, often show a concavity, for which there may be two explanations: this may either represent the partial wearing away of the crown in the old forms, or it may be induced by flaking of the upper surface after the teeth were isolated, the polishing, and other abrasion being the result of rolling. In certain cases with rolled specimens, the root surface or inferior face is often irregularly barred or transversely striated, giving it a resemblance to worn teeth of the type of *Myliobatis*; but from an extensive series it is seen that this is the result of the peculiar pattern of the vasodentinal channels which trend transversely across the crown of the tooth. In the description of this species in 1904, it was stated that the surface of the crown "is apparently much smoother than that of the living species," *C. philippi*. A series of over three hundred specimens have been collected from Beaumaris by one of us (F.A.C.) during recent years. The greater number are either worn smooth, or show the sub-median ridge and surface pitting only near the extremities; several, however, are perfectly preserved, showing that *C. cainozoicus* has a similar vermiculate pitting to that seen in *C. philippi*. On the other hand, the teeth of the living species are almost invariably acuminate at the diagonal extremities as distinguished from the more rectangular form of *C. cainozoicus*, and, moreover, in the same species, the median ridge generally shows a parallel and subjacent ridge where the borders of the vermiculae spread out horizontally.

One of the most solid forms of the median series is represented by a specimen measuring 23mm. in length, 12mm. in width and 6.5mm. in thickness; collected by Mr. H. Mathias and presented by him to the National Museum.

The previous record of this species from Curlewis should be deleted, as the specimen is now transferred to *C. longidens*, sp. nov. (see *postea*). A tooth from the Mallee Bores (Bore 8, 210-219ft.) previously referred to this species is now recorded as *C. novo-*

zelandicus (see *postea*); we note that *C. cainozoicus* did not occur in the bores.

It is interesting to note the occurrence in the northern hemisphere of several species of *Cestracion*. *C. falcifer*, Wagner, is found in the Lower Kimmeridgian of Bavaria, *C. sulcatus*, A. S. Woodward, in the Cenomanian of Kent, *C. canaliculatus*, Egerton, in the Cenomanian of south-east England and *C. rugosus*, Agassiz sp., in the Cenomanian of England and the Danian of Holland. Amongst other undetermined species (British Museum) is one from the London Clay of Highgate Archway. From Belgium, *C. duponti*, Winkler is recorded from the Middle Eocene, and there are other species in the Cenomanian and Turonian of Saxony and Bohemia.

Occurrence.—Kalimnan. From the nodule band at the base of the cliffs, Beaumaris, Port Phillip; also from the nodule band at Grange Burn. We regard these deposits as partly remanié from a probable Janjukian horizon, or from one intermediate between that and the Kalimnan. F. Chapman has remarked on similar deposits at Muddy Creek and Grange Burn (1914, Mem. Nat. Mus., No. 5, p. 47) as follows: "The nodule bed, I was at one time inclined to think, represented a remanié deposit of the Janjukian series, but my recent visit convinces me that it is the basal bed of the Kalimnan. It consists, as before stated, of cetacean and turtle bones, fish teeth, etc., and lies embedded in a stiff brown clay. The rolled portion of the deposit is probably derived from the underlying Janjukian, since I discovered in a similar bed on the Muddy Creek a scutum of *Lepas pritchardi*, a fossil only found, hitherto, at Waurn Ponds and Torquay in undoubted Janjukian strata. The brown clay of the nodule bed usually contains typical Kalimnan fossils, thus proving the age of the deposit, and making it without a doubt a conglomeratic basal bed." The following are new localities for this species: Janjukian. Upper and lower beds, Table Cape, Tasmania, (Nat. Mus. Coll., pres. by F. A. Cudmore). Bird Rock Cliffs, Torquay (Nat. Mus. Coll., pres. by Mr. W. J. Parr).

CESTRACION COLERIDGENSIS, Chapman.

(Plate IX., fig. 8.)

(?) *Acrodus rothi*, Ameghino, 1906, Anales del Museo Nacional de Buenos Aires, ser. 3, vol. VIII., p. 177, pl. I., figs. 4, 4*a*, 4*c*, 5*a*.

Cestracion coleridgensis, Chapman, 1918, N. Z. Geol. Surv., Pal. Bull. No. 7, p. 6, pl. IX., figs. 3*a*, 3*b*.

Observations.—The above species was first described from New Zealand specimens, found in the Mt. Brown series (Miocene) of

1.—For the present, *on the ground of usage*, we are retaining the generic term *Cestracion*, Cuvier (1817), in preference to *Heterodontus*, Blainville (1816), which predates it by one year. The latter name is by some regarded as synonymous with *Heterodon*, Palisot de Beauvois (1800), (an Ophidian), which supersedes it by priority. The difference in spelling, however, would make the two terms distinct.

Coleridge Creek, Trelissick Basin, Canterbury. Quite a fair number of this species occur at Beaumaris, where it is found amongst other fish remains in the material worn out at the base of the cliffs. These specimens from Beaumaris resemble the New Zealand forms in point of size, but are more or less water-worn and in most cases have lost the rugose surface of the crown. One or two, however, from the same locality, show both the median ridge and the roughened surface. A specimen from the lower bed, Table Cape, about half as long again as the average examples, evidently belonging to this species, is in a remarkable state of preservation; the base is much flatter than in *C. cainozoicus* with a sharply projecting rim, whilst the crown has a well-defined median ridge from which proceed a sub-parallel series of vermiculate ridges. Two specimens from the upper or *Turritella* bed at Table Cape are small examples but they exhibit the narrow proportions of the above species and the median coronal keel is very distinct.

The species described by Winkler[2] and A. S. Woodward[3] from the Eocene of Brussels and London respectively, under the name *Cestracion duponti*, Winkler, is represented by a more regularly fusiform type of tooth than in *C. coleridgensis*, and in fact, links up with the Cretaceous forms which more nearly approach the genus *Acrodus*.

From the Patagonian formation of Buenos Aires, Ameghino has figured a closely allied, if not identical, species under the name *Acrodus rothi*. It is a slender form with somewhat undulating margins, but the ornamentation of the coronal surface is more thread-like than in the above species, while it differs in its more depressed crown.

Occurrence.—From beds at the base of the Kalimnan and usually found in the shingle. We have never found this species in situ in the upper beds at Beaumaris. Janjukian. Lower bed, Table Cape, Tasmania (length 20.5mm., width 12mm., height, 4mm.); also from the upper bed at the same locality. Collected from all these localities by F. A. Cudmore and presented by him to the Nat. Museum.

CESTRACION NOVO-ZELANDICUS, Chapman.

(Plate IX., fig. 9.)

"Otoliths, ? *Sargus*." Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 45, pl. VII., fig. 8.

(?) *Acrodus basalduai*, Ameghino, 1906, Anales del Museo Nacional de Buenos Aires, ser. 3, vol. VIII., p. 177, pl. I., figs. 2, 2*a*, 3.

Cestracion novo-zelandicus. Chapman, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 7, pl. VII., figs. 8*a-c*; pl. IX., figs. 4*a*, *b*, 5*a*, *b*.

Observations.—Amongst the teeth of *Cestracion* found at Beaumaris we have noticed some which were formerly regarded as

2.—Winkler, 1876,[2] p. 17, pl. ii., figs. 1, 2, 3.
3.—A. S. Woodward, 1891, p. 105, pl. iii., fig. 1.

C. cainozoicus that differ from that species by being, not only more oblong, but in having a thinner build and a thicker sub-median ridge. This type of tooth no doubt belongs to the New Zealand *C. novo-zelandicus* which there occurred in the Mt. Brown series, Trelissick Basin. As in the New Zealand specimens, the present series is more closely comparable with the living Port Jackson shark (*C. philippi*) than to the teeth of the common Australian fossil species, *C. cainozoicus*, which, we note, has not so far been found in New Zealand.

It is interesting to note that in the Mallee Bores (Bore 8, 210-219ft.) an anterior lateral crushing tooth of the above species was found in a bed which may be relegated to the top of the Janjukian. This occurrence has an important bearing on the age of the Beaumaris horizon, where we regard the basal beds as probably Upper Miocene. This specimen was previously referred to *C. cainozoicus*, which species did not occur in the Mallee Bores[4].

The teeth figured by Ameghino from the Patagonian formation of Buenos Aires under the name *Acrodus basalduai* appear to belong to the genus *Cestracion* and not to *Acrodus, sensu stricto*, on account of the structure seen on the crown. The particular species mentioned agrees in general outline with the New Zealand and Australian form *C. novo-zelandicus*, but the vermiculate structure of the coronal surface is somewhat different.

Dimensions of Beaumaris Examples.—A small specimen: length, 9mm.; width, 4.5mm. A large specimen: length, 15mm.; width, 7mm.

Occurrence.—Base of Kalimnan at Beaumaris (Nat. Mus. Coll., pres. by F. A. Cudmore). Examples not infrequent.

From the top of the Janjukian in the Mallee Bores (Bore 8, 210-219ft.). This is the specimen figured by Chapman and Gabriel, and is in the National Museum Collection.

Cestracion longidens, sp. nov.

(Plate IX., fig. 10.)

Description of Holotype.—Teeth elongate, gently curved; crown gently arcuate; base flatly convex and truncately bevelled to meet the coronal edge. The margin between root and crown is indicated by a sharp edge and immediately above this on the inner or concave side is an articulating groove. The coronal surface of the tooth shows on the unworn ends a strong vermiculate pitting, and along the inner margin at a short distance from the edge runs a low, but fairly conspicuous, ridge, which is also a feature of *C. cainozoicus*.

Dimensions of Holotype.—Length, 30mm., greatest width, 11 mm.; greatest height in the centre, 6mm.

4.—Chapman & Gabriel, 1914, p. 55, pl. x., fig. 55; Chapman, 1916, pl. lxvii., fig. 55.

Observations.—A large number of teeth of the fossil forms of *Cestracion* have generally been referred to *C. cainozoicus*; some of these attain extraordinarily long dimensions as compared with the figured and typical forms known as *C. cainozoicus.* These elongated forms we now separate as a new species; at the same time it will be necessary to state our view of the differential characters of each. In the first place, *C. longidens* is typified by a longer and proportionately narrower tooth and it is comparatively thinner than in *C. cainozoicus.* Another character we observe is that the longitudinal coronal ridge seen in both species is nearer the edge in *C. longidens* and is not so sharply sculptured. Judging from the material at present before us, the size of *C. longidens* seems to range from about 22mm. to 30mm. A specimen from Beaumaris, collected by Mr. W. Kershaw in 1868, has a length of 28.5mm., with a width of 10mm.

Occurrence.—Holotype from Beaumaris; collected and presented to Nat. Museum by Mr. F. A. Singleton. Beaumaris (Nat. Mus. Coll., coll. by the late Mr. W. Kershaw; pres. by the late Mr. W. B. Jennings; also in F.A.C. Coll.). Janjukian. Curlewis, near Geelong (Nat. Mus. Coll., pres. by Mr. A. C. Curlewis).

Genus **Strophodus**, Agassiz.

Strophodus eocenicus, Tate.

(Plate IX., fig. 11.)

Strophodus eocenicus, Tate, 1894, Proc. Roy. Soc. N.S.W., p. 169, pl. XIII., fig. 6. Dennant and Kitson, 1903, Rec. Geol. Surv. Vict., vol. I., pt. 2, p. 94.

Asteracanthus eocaenicus, Tate sp., Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 271, pl. XI., figs. 3, 4; pl. XII., fig. 1. Chapman, 1914, Australasian Fossils, pages 269, 271, 307.

Observations.—It is a little difficult at first sight to separate some of the more elongated forms of teeth of *Cestracion* from those of *Strophodus*[1], but after examining an extensive series from Beaumaris, we notice some points of difference generally constant.

There was, of course, no difficulty with the larger forms of *Strophodus* teeth, but with the smaller ones we note that the outer edge in *Strophodus* is almost perfectly straight or only slightly concave, the articulating grooves are more pronounced, the crown is flatter, and there is an almost entire absence of the median ridge or keel so prominent a feature on the crown of *Cestracion.* As was pre-

1.—It has hitherto been customary to refer *Strophodus* (teeth only) to the genus *Asteracanthus* (spines only), as in some cases they have been associated, indicating a probable generic relationship. In the present case, no spines have been found, and we revert, therefore, to the genus *Strophodus* for our Australian teeth of that type.

viously pointed out by Chapman and Pritchard[2], the microscopic structure seen in the teeth of *Strophodus* and *Cestracion* respectively is sufficiently marked to make the identification reliable. Some of the finest examples of the teeth of *Strophodus* have been collected by one of us (F.A.C.) from Table Cape, Tasmania, a new locality, and these specimens have helped considerably in the separation and diagnosis of this interesting form. It is worth noting that the colour of these Table Cape specimens is almost jet black, probably due to their being largely replaced by vivianite, and this seems to have been occasioned by their occurrence in an ironstone bed, the *Crassatellites* bed. On the other hand, those found at Beaumaris are partially replaced by vivianite and often show remarkable variegation of greenish-blue to brown.

Teeth referred to *Strophodus* have been recorded from the Inferior Oolite of Lincolnshire (*S. magnus*, Agassiz), and from the Bathonian of Oxfordshire, Wiltshire and other places in England (*S. tenuis*. Ag.). The latter species has occurred in the Brown Jura of Würtemburg. From the Kimmeridgian of the north of France *S. beaugrandi*, Sauvage, has been recorded; several other species occur in the Jurassic of France and Germany, whilst the youngest species of the northern hemisphere, *S. punctatus*, Agassiz, comes from the Cenomanian of Bavaria.

Additional Occurrence.—From the base of the Kalimnan at Beaumaris, where they are somewhat rare. Usually found worn or in a damaged condition (F.A.C. Coll.). Janjukian. From both the upper and lower beds at Table Cape, Tasmania (Nat. Mus. Coll., pres. by F. A. Cudmore).

Family CARCHARIIDAE, Müller and Henle.

Genus **Hemipristis**, Agassiz.

HEMIPRISTIS SERRA, Agassiz.

(Plate IX., fig. 12.)

Hemipristis serra, Agassiz, 1843, Poiss. Foss., vol. III., p. 237, pl. XXVII., figs. 18-30.

Lamna (*Odontaspis*) *hopei*, R. W. Gibbes (non Agassiz), 1849, Journ. Acad. Nat. Sci. Philad., ser. 2, vol. I., p. 198, pl. XXVI., figs. 120-123.

Hemipristis serra, Ag., J. Probst, 1878, Württ. Jahresh., vol. XXXIV., p. 143, pl. 8., fig. 49-57.

Hemipristis serra, Ag., K. Martin, 1887, Samml. geol. Reichs-Mus. Leiden, ser. 1, vol. III., p. 26, pl. II., fig 17.

Hemipristis serra, Agassiz, Smith Woodward, 1889, Cat. Foss. Fishes, Brit. Mus. Nat. Hist., pt. 1, p. 449. Zittel (Eastman), 1902, vol. II., p. 32, fig. 59.

2.—1904, p. 272.

Eastman, 1904, Maryland Geol. Surv. Miocene, p. 90, pl. XXXII., fig. 13*a*, 13*b*, 14*a*. Ameghino, 1906, Anales del Mus. Nac. Buenos Aires, ser. 3, vol. VIII., p. 464, 502. Leriche, 1908, Anales Soc. géol. du Nord, vol. XXXVII., p. 305.

Observations.—It has, for a long time, been the quest of collectors in Australia to find evidences of the above genus, since it is so widely distributed in the Tertiaries of the northern hemisphere, so that the discovery of it by one of us (F.A.C.) in the Murray River Cliffs was of more than ordinary interest. Up to the present the known localities for this species are Würtemberg, which yielded Agassiz' original type of the genus, and other Miocene localities in Italy, Sicily, Malta, Corsica, Switzerland, France, and Austria. In the Miocene of North America, it is very common in South Carolina, Maryland, and Virginia. The Florida phosphate beds contain an abundance of this species, shipments of which are occasionally made to Yarraville, near Melbourne. It has also been recorded as occurring in some numbers in the Patagonian Tertiaries in the neighbourhood of Parana and at the Golfo Nuevo. *H. serra* has also been recorded from the Pliocene of Tuscany and from the Tertiary beds of Ngembak, Java[1], the latter locality being the nearest one to the Australian. There is no doubt of the specimen from the Murray River Cliffs having been found in situ, as it was picked out from the undisturbed fossiliferous marl bed near Morgan, South Australia. This specimen is in a good state of preservation; near the base it is pale ochreous in colour, but approaching the apex it becomes almost opalescent with a pale bluish tint; this colouring is typical of other teeth found in the same bed. It almost exactly matches in size and form Agassiz' figures 28-30 on plate XXVII. of the "Poissons Fossiles." It is interesting to note that a living species of this genus (*H. elongatus*, Klunzinger sp.) is found in the Red Sea.

Dimensions.—Base slightly imperfect, height from the base to apex, 21.5mm.; width, imperfect, 15.5mm.; thickness near the base, 5.5mm. The denticles on the posterior cutting edge number thirteen, on the anterior twenty-two.

Occurrence.—Janjukian. Cliff one mile below Pelican Point, Murray River, left bank, South Australia. Nat. Mus. Coll., pres. by F. A. Cudmore.

Genus, **Galeocerdo**, Müller and Henle. (Tiger sharks.)

GALEOCERDO DAVISI, Chapman and Pritchard.

Notidanus marginalis, Davis (pars), 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 34, pl. VI., fig. 7 (non fig. 8).

Galeocardo sp., 1889, A. S. Woodward, Cat. Foss. Fishes, Brit. Mus. Nat. Hist., pt. 1, p. 167.

1.—This specimen was found in the upper beds at Ngembak, which are regarded as on a Lower Miocene horizon by Dr. Martin. See "Unsere Palæozoologische Kenntniss von Java," 1919, p. 30.

Galeocerdo davisi, Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 273. Chapman, 1914, Australasian Fossils, p. 269, 271. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, pl. VI., figs. 7 *a-c*.

Observations.—To the earlier record of the localities given in 1904 (*loc. supra cit.*), we add the locality of the railway cutting at South Yarra, Melbourne, now, unfortunately, inaccessible for collecting purposes. This bed is apparently on the same horizon as the Flemington ironstone beds at the summit of the Janjukian. The two specimens were presented by the late Mr. W. B. Jennings, in 1885. They are decidedly water-worn, and indicate a formation which is either remanié or has been subjected to a great deal of current action.

Additional Occurrence.—Upper Janjukian. South Yarra, Melbourne (Nat. Mus. Coll., pres. by the late Mr. W. B. Jennings).

GALEOCERDO LATIDENS, Agassiz.

Galeocerdo latidens, Agassiz, 1843, Poiss. Foss., vol. III., p. 231, pl. XXVI., figs. 22, 23. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 444. Idem, 1899, Proc. Geol. Assoc., vol. XVI., p. 12, pl. I., figs, 31, 32. Eastman, 1901, Maryland Geol. Surv. Eocene, p. 109, pl. XIV., fig. 8. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 273. Eastman, 1904, Maryland Geol. Surv. Miocene, p. 88, pl. XXXII., fig. 10. Chapman, 1914, Australasian Fossils, p. 271, fig. 131*c*. Priem, 1914, Bull. Soc. géol. France, ser. 4, vol. XIV., p. 378.

Observations.—No new localities have been recorded for this species.

GALEOCERDO ADUNCUS, Agassiz.

Galeocerdo aduncus, Agassiz, 1843, Poiss. Foss., vol. III., p. 231, pl. XXVI., figs. 24-28. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 444. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII (N.S.), pt. 1, p. 274. Eastman, 1904, Maryland Geol. Surv. Miocene, p. 88, pl. XXXII., fig. 11. Chapman, 1914, Australasian Fossils, p. 271. Idem, 1916, Rec. Geol. Surv. Vict., vol. III., pt. 4, p. 339, 379.

Additional Occurrence.—From the top of the Janjukian in the Mallee Bores, Victoria (No. 4, 163-170ft.); Nat. Mus. Coll.

Genus **Carcharias**, Cuvier. (The Grey and the Blue Nurse Sharks.)

CARCHARIAS COLLATA, Eastman.

(Plate IX., figs. 13-16.)

Carcharias collata, Eastman, 1904, Maryland Geol. Surv. Miocene, p. 85, pl. XXXII., figs. 3*a*, 3*b*, 4*a*, 5.

Original Description.—"A species of moderate size, the teeth comparatively stout, with a narrow, usually erect crown, strongly convex on its inner, and slightly so on its outer, face; apex sometimes slightly curved inwards or backwards; coronal edges with extremely minute serrations disappearing towards the base. The enamel at the base of crown extends much lower down in the middle of the outer than on the inner face. The root is considerably elongated, large, and symmetrical."

Observations.—The specimens from Beaumaris agree in the main characters with the teeth described by Eastman (*loc. supra cit.*). Eastman mentions in his description that the coronal edges have extremely minute serrations. These we have failed to detect up to the present, but their absence may be easily accounted for when we consider that the edges are more or less water-worn. We may incidentally mention in regard to this that some specimens of *C. collata* from the type locality of Chesapeake Bay in the collection of one of us (F.A.C.), which were obtained by favour of Mr. Raymond Hibbard, also show no signs of serrations on the coronal edges, probably through erosion.

Practically all the specimens from Beaumaris are of smaller dimensions than the Maryland specimens, but this feature hardly justifies a varietal distinction, especially since specimens in the Hibbard collection are just as small.

For the present we place this species under the genus *Carcharias, sensu stricto*, as it differs from the group *Aprionodon* (according to Eastman's description) in having fine serrations on the coronal edges.

The almost horizontal or open V-shaped base and the comparatively short, slender crown makes this species easily separable from worn specimens of *C. aculeatus*.

Occurrence.—Kalimnan. Beaumaris; usually found in the shingle and probably from the nodule bed. Only about a dozen specimens are known to us from this locality. Nat. Mus. Coll., collected and presented by Mr. F. A. Cudmore.

CARCHARIAS VICTORIAE, sp. nov.

(Plate IX., figs. 17, 18.)

Description.—Teeth rather small, root equally proportionate to crown in height, teeth presumably of the upper jaw, shaped as in *G. aculeatus*, in which the crown is sharply curved backwards, but differing in being almost devoid of serrations, except close to the

base. Teeth presumably of the lower jaw, with the crown having less backward curvature and sometimes almost vertical. Serrations absent except near the base. Base of tooth strong, expanded laterally, and with the central notch strongly marked.

Dimensions.—Upper tooth (Table Cape): height, 8mm.; length of base, 11.5mm.; height of crown, 5.5mm.

Tooth from lower jaw (Beaumaris): height, 10mm.; length of base when complete, *circa* 10.5mm.; height of crown, 6.5mm.

Observations.—The Victorian species appears to be nearest *C. magna*, Cope sp.[2]. Some strong points of difference are, however, observable which are here regarded as specific. In our species the crown is not so prominent nor projecting so far back proportionately, and the teeth are never much more than half the height of the Maryland specimens, which were from the Miocene or Calvert formation of Charles Co. near the Patuxent River. In the Nat. Mus. Coll. there are specimens of Cope's species from Florida which correspond with those from Maryland.

Occurrence.—Kalimnan. Several examples from Beaumaris, including co-type; Nat. Mus. Coll., coll. and pres. by F. A. Cudmore. Janjukian. One specimen (co-type) from the upper beds, Table Cape, Tasmania; Nat. Mus. Coll., coll. and pres. by F. A. Cudmore.

Subgenus **Prionodon**, Müller and Henle.

CARCHARIAS (PRIONODON) ACULEATUS, Davis sp.

(Plate IX., figs., 19, 20.)

Galeocerdo aculeatus, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 8, pl. I., figs. 1-3.

Carcharias (Prionodon) aculeatus. Davis sp., 1889, A. S. Woodward, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 440. Chapman, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 8, pl. I., figs. 1*a-c*, 2*a*. 2*b*, 3.

Observations.—This species has only within recent years been identified in the Australian Tertiaries, but it is a common form in some horizons, as in the basal beds at Beaumaris. Specimens from the Janjukian series (marly limestones) at Neumerella, near Orbost, East Gippsland, are very well preserved and are identical with Davis' type specimens from the Miocene of Coleridge Gully, Trelissick Basin, New Zealand. A Balcombian example here referred to this species, from the blue marly clays of Grice's Creek, Port Phillip, shows the denticles of the crown to be much finer and closer than usual; but this distinction perhaps hardly warrants a new trivial name.

Concomitantly with the comparative abundance of *C. aculeatus* in the Beaumaris beds, we find a great variation in form, in the one

2.—*Sphyrna magna*, Cope, 1867, Proc. Acad. Nat. Sci. Philad., vol. XIX., p. 142. *Carcharias magna*, Cope sp., Eastman, 1904, Maryland Geol. Surv. Miocene, p. 86, pl. XXXII., figs. 6*a*, 6*b*, 7*a*, 7*b*.

extreme the tooth having a stout and broad crown, which is slightly oblique, and in the other the crown being central to the base, nearly upright and quite narrow.

Occurrence.—Kalimnan. From the base of the Kalimnan at Beaumaris (Nat. Mus. Coll., pres. by F. A. Cudmore). Also an exceptionally large specimen from the same locality collected by Mr. H. Mathias (Nat. Mus. Coll.). Janjukian. Neumerella, near Orbost, East Gippsland (coll. F. Chapman, Nat. Mus.). Mallee Bores (Bore 9, 315-325ft.). Balcombian. From the blue clays at Grice's Creek (Nat. Mus. Coll., pres. by F. A. Cudmore). Clifton Bank, Muddy Creek (F. Chapman Coll.).

Carcharias (prionodon) incidens, Eastman.

(Plate IX., fig. 21.)

Carcharias incidens, Eastman, 1904, Maryland Geol. Surv. Miocene, p. 87, pl. XXXII., fig. 8.

Original Description.—"Teeth robust, triangular, prominently serrated along the entire coronal margin on both sides. Posterior margin only slightly concave, the anterior nearly straight. Root deep, not produced beyond the base of the crown on either side.

"The unique example on which this species is founded resembles in general form certain species of *Corax* from the Cretaceous, and is readily distinguished from other teeth pertaining to *Carcharias*, the roots of which are expanded and the coronal margins less prominently and completely serrated. The form under consideration also bears some resemblance to that described by Noetling as *Galeocerdo dubius* from the Prussian Eocene (Abh. geol. Specialk. Preussen u. Thüring. Staaten, vol. VI., pt. 3, 1885, p. 97, pl. V., fig. 6). Both faces of the crown are convex, the inner more so than the outer. The total height of the tooth is 14mm., the width 15mm., and the thickness of the crown at the middle of the base 4mm." This tooth came from the Calvert formation (Miocene) at Chesapeake Beach.

Observations.—The tooth which we refer to the above species was at first regarded as a small example of *Carcharodon*, but the decided obliquity of the crown, which gives it a form like that of *Corax*, has suggested its nearer affinity to *Carcharias*. As it almost exactly matches the figure of the above species given by Eastman, we have no hesitation in referring it to the form described by him. Height of tooth from base to apex, measured on the long anterior side, 21mm.; width at base, 19mm.; thickness of crown at the middle of the base, 4mm.

Occurrence.—Janjukian. Red Hill, Shelford (Nat. Mus. Coll., pres. by Mr. J. H. Young).

CARCHARIAS (PRIONODON) JAVANUS, Martin.

(Plate IX., fig. 22.)

Carcharias (Prionodon) javanus, K. Martin 1887, Samml. Geol. Reichs-Mus. Leiden, p. 27, pl. II., fig. 19, 19*a*, 20.

Observations.—Two examples of a narrowly hastate type of tooth with fine shallow edge serrations were found by one of us whilst sorting over a quantity of coarse washing from the Balcombian of Clifton Bank, Muddy Creek. They agree so closely with Martin's species that we have no hesitation in ascribing them to it. The larger of the two co-types figured by Martin measures 12mm. in height; the larger of our specimens measures 9mm. Dr. Martin has remarked on their resemblance to teeth of the living *Carcharias (Prionodon) oxyrhynchus*, Müller and Henle, and we might point out their resemblance also to the anterior teeth of the lower jaw of *Carcharias (Prionodon) glyphis*, Müller and Henle.

Occurrence.—Balcombian. Clifton Bank, Muddy Creek (Nat. Mus. Coll., pres. by F. A. Cudmore).

Genus **Carcharoides**, Ameghino.

CARCHAROIDES TOTUSERRATUS, Ameghino.

Carcharoides totuserratus, Ameghino, 1901, Bol. Acad. Nac. Cienc. Cordoba, vol. XVI., p. 102. Idem, 1906, "Les Formations Sedimentaires du Crétacé Supérieur et du Tertiare de Patagonie," Anales del Museo Nacional de Buenos Aires, ser. 3, vol. VIII., p. 183 (footnote), and woodcut fig. 50. Chapman, 1913, Vict. Naturalist, vol. XXX., p. 142, 143.

Observations.—A single further specimen showing the curved crown but lacking the root.

Additional Occurrence.—Filter Quarries, Batesford (T. S. Hall Coll).

CARCHAROIDES TENUIDENS, Chapman.

cf. *Carcharias (Prionodon) acutus*, non Agassiz, Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 274.

Carcharoides tenuidens, Chapman, 1913, Victorian Naturalist, vol. XXX., p. 142, 143, and woodcut. Idem, 1914, Australasian Fossils, p. 270, fig. 131*a*. Idem, 1917, Proc. Roy. Soc. Vict., vol. XXIX. (N.S.), pt. II., p. 136, pl. IX., fig. 3.

Observations.—Several further specimens from Waurn Ponds (T.S.H. Coll.).

Genus **Sphyrna**, Rafinesque. (Hammerhead sharks.)

SPHYRNA PRISCA, Agassiz.

(Plate IX., fig. 23.)

Sphyrna prisca, Agassiz, 1843, Poiss. Foss., vol. III., p. 234, pl. XXVI*a*., figs. 35-50. A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 453. Eastman, 1901, Maryland Geol. Surv. Eocene, p. 110, pl. XIV., fig. 7. Idem, Miocene, 1904, p. 91, pl. XXXII., fig. 15. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 275, pl. XI., fig. 9. Chapman, 1914, Australasian Fossils, p. 270.

Observations.—As Smith Woodward has already pointed out (*loc. supra cit.*), it is almost impossible to separate *Sphyrna* from *Carcharias* on the separate teeth. There are apparently some points of difference, however, as the more defined and equiangular crown in *Sphyrna*, with its fine serrations near the base and its smooth apex. Two, at least, of the examples in the Nat. Mus. Coll. agree in this, one being the plesiotype figured by Chapman and Pritchard, and another presented by F. A. Cudmore.

Additional Occurrence.—Janjukian. Batesford (Nat. Mus. Coll., from the T. S. Hall Coll., pres. by F. A. Cudmore.) Balcombian. Clifton Bank, Muddy Creek (Nat. Mus. Coll., pres. by F. A. Cudmore).

Family LAMNIDAE, Müller and Henle.

Genus **Odontaspis**, Agassiz. (Bull-dog sharks.)

ODONTASPIS CONTORTIDENS, Agassiz.

(Plate IX., fig. 24.)

Lamna (Odontaspis) contortidens, Agassiz, 1843, Poiss. Foss., vol III., p. 294, pl. XXXVII *a*., figs. 17-23.

Odontaspis contortidens, Agassiz, A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 366. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 275.

Odontaspis acutissima, Agassiz, Leriche, 1910, Annales Soc. géol. du Nord, vol. XXXIX., p. 327, pl. III., figs. 2-8.

Odontaspis contortidens, Agassiz, Chapman, 1914, Australasian Fossils, p. 269-271, fig. 131b. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 11, text-figs. 1*a*, 1*b*.

Observations.—This species was doubtfully recorded from Batesford by Chapman and Pritchard. It is now definitely proved to occur there. Although a large part of the base is missing in most of the specimens, which, altogether, number sixteen, the crown is beautifully preserved, showing in most cases the striated inner surface, which is strong near the base and dying out at about a third from the apex.

A fine specimen from Grange Burn shows the original basal striations, unlike those previously recorded, which were remarked upon (*loc. supra cit.*) by Chapman and Pritchard as " all more or less worn, and therefore probably derived from the Balcombian." This specimen was presented to the Nat. Museum Coll. by Mr. S. F. Mann. Leriche considers (*loc. supra cit.*) that the teeth figured by Agassiz in his "Poissons fossiles" under the names *Lamna (Odontaspis) acutissima* and *contortidens* are teeth of the same species from different parts of the jaw.

Additional Occurrence. — Upper Pliocene. Limestone Creek (="Lamna" of Dennant); Nat. Mus. Coll. Janjukian. Batesford (Nat. Mus. Coll., pres. by Mr. J. A. Tonks); 60ft. down, Batesford Quarries (Nat. Mus. Coll., pres by Mr. D. Culliney); Filter Quarries, Batesford (T. S. Hall Coll.). Beach, Rivernooke (T. S. Hall Coll.). From the black clays on the beach half way between Point Addis and Anglesea (T. S. Hall Coll.). Neumerella, near Orbost, East Gippsland (coll. F. Chapman Nat. Mus.). Balcombian. From the yellow clays at Grice's Creek, Port Phillip (Nat. Mus. Coll., pres. by F. A. Cudmore). From the blue clays at Balcombe Bay (Nat. Mus. Coll., pres. by F. A. Cudmore).

ODONTASPIS INCURVA, Davis sp.

Lamna incurva, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 17, pl. III., figs. 3-5

Odontaspis incurva, Davis sp., A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 372. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol XVII. (N.S.), pt. 1, p. 276. Chapman, 1914, Australasian Fossils, p. 269,271. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 13, pl. III., figs. 3-5.

Observations.—As regards this species we have to record additional localities which make this species in Victoria definitely Janjukian as well as Kalimnan. None of the specimens have much of the base preserved.

Additional Occurrence.—(?) Kalimnan. Near the top of cliffs at Morgan, South Australia (Nat. Mus. Coll., pres. by F. A. Cudmore); age of stratum still uncertain. Janjukian. Batesford, near Geelong, 60ft. down (Nat. Mus. Coll., pres. by Mr. D. Culliney); also from the same locality (Nat. Mus. Coll., pres. by Mr. J. A. Tonks). Neumerella, near Orbost, East Gippsland (coll. F. Chapman Nat. Mus.). Clyde Quarry, near Geelong (T. S. Hall Coll.).

ODONTASPIS ELEGANS, Agassiz sp.

Lamna elegans, Agassiz, 1843, Poiss. Foss., vol. III., p. 289, pl. XXXV., figs. 1-5 (non fig. 6, 7); pl. XXXVIIa., fig. 59 (non fig. 58). R. W. Gibbes, 1849, Journ. Acad. Nat. Sci. Philad., ser. 2, vol.

I., p. 196, pl. XXV., figs. 98-102 (? figs. 96, 97). Dixon, 1850, Geol. and Foss. Sussex, p. 203, pl. X., figs. 28-31. McCoy, 1867, Ann. Mag. Nat. Hist., ser. 3, vol. XX., p. 192. Idem, 1874, in Brough Smyth's Prog. Rept. No. 1, p. 35. Johnston, 1877, Proc. Roy. Soc. Tas. for 1876, p. 86.

Lamna huttoni, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 15, pl. III., fig. 1.

Odontaspis elegans, Agassiz sp., A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 361. Idem, 1891, Geol. Mag., dec. 3, vol. VIII., p. 105. Idem, 1899, Proc. Geol. Assoc., vol. XVI., p. 8, pl. I., figs. 15-18. Eastman, 1901, Maryland Geol. Surv. Eocene, p. 104, pl. XIV., figs. 2*a*, 2*b*, 2*c*, 3*a*, 3*b*, 3*c*. Idem, 1904, ibid., Miocene, p. 79, pl. XXX., figs. 2*a*, 2*b* and 3. Chapman, 1917, Proc. Roy. Soc. Vict., vol. XXIX. (N.S.), pt. 2, p. 137, pl. IX., fig. 4.

Observations.—In well preserved specimens the inner surface of the crown near the base is vertically striated after the manner of *O. contortidens*, from which it differs in its generally larger size and less sinuous contour. There are two specimens from Table Cape, Tasmania, in the Nat. Mus. Coll. (R. N. Atkinson Coll.)

Additional Occurrence.—Janjukian. Batesford, 60ft. down in quarry (Nat. Mus. Coll., pres. by Mr. D. Culliney). From the Umpherstone's Cave, Mt. Gambier (T. S. Hall Coll., pres. to Nat. Mus. by F. A. Cudmore). Red Hill, Shelford (T. S. Hall Coll., pres. to Nat. Mus. by F. A. Cudmore). A doubtful specimen from Bird Rock Cliffs, Torquay (Nat. Mus. Coll., pres. by F. A. Cudmore).

ODONTASPIS ATTENUATA, Davis sp.

Lamna attenuata, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 19, pl. III., fig. 11*a-c*.

Odontaspis attenuata, Davis sp., A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 374. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 277, pl. XI., figs. 10, 11. Chapman, 1914, Australasian Fossils, p. 270, 271.

Observations.—Three very fine specimens are here recorded for the first time from Batesford. An additional example from Beaumaris, collected by one of us (F.A.C.), is beautifully preserved.

Additional Occurrence.—Janjukian. 60ft. down, quarry at Batesford (Nat. Mus. Coll., pres. by Mr. D. Culliney). Filter Quarries, Batesford (T. S. Hall Coll.). Bird Rock Cliffs, Torquay (Nat. Mus. Coll., pres. by F. A. Cudmore).

ODONTASPIS CUSPIDATA, Agassiz sp.

(Plate X., figs. 25, 26.)

Lamna cuspidata, Agassiz, 1843, Poiss. Foss., vol III., p. 290, pl. XXXVII*a*. figs. 43-50. Gibbes, 1849, Journ. Acad. Nat. Sci. Philad., ser. 2, vol. I., p. 197, pl. XXV., figs. 103-106.

Odontaspis cuspidata, Agassiz sp., A. S Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 368. Idem, 1899, Proc. Geol. Assoc., vol. XVI., p. 7, pl. I., figs. 12-14. Eastman, 1901, Maryland Geol. Surv. Eocene, p. 105, pl. XIV., figs. 1*a*, 1*b*, 6*a*, 6*b*. Leriche, 1902, Mem. Mus. d'Hist. nat. Belg., vol. V., p. 268, pl. XV., fig. 1-21. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 276, Eastman, 1904, Maryland Geol. Surv. Miocene, p. 78, pl. XXX., figs. 1*a*, 1*b*. Leriche, 1908, Anales Soc. Geol. du Nord, p. 238, 303, pl. IV. Chapman, 1914, Australasian Fossils, p. 269, 271. Priem, 1914, Bull. Soc. Geol. France, ser. 4, vol. XIV., p. 378, 380.

Observations.—In addition to the records of this species previously made by Chapman and Pritchard, we have the good series collected by one of us (F.A.C.) from the upper bed (*Turritella*) of Table Cape, Tasmania. Two of these examples probably represent anterior teeth, and one of them is of an immature type with a very short crown. There are also several with shorter crowns probably representing the intermediate lateral part of the series. In the Table Cape specimens the lateral cusps are very well preserved in almost every case. In the former description of *O. cuspidata* (Chap. and Prit., 1904), *Lamna marginalis*, Davis was inadvertently included in the synonymy, but that species is probably synonymous with *Lamna compressa* and therefore the previous reference of its New Zealand occurrence as *O. cuspidata* should be deleted. (See also Chapman, Geol. Surv. Branch, Dept. Mines, New Zealand, Pal. Bull. No. 7, p. 15).

Additional Occurrence.—In a hard shelly rock near the top of the *Turritella* bed, Table Cape, Tasmania. Janjukian. Nat. Mus. Coll., pres. by F. A. Cudmore.

ODONTASPIS RUTOTI, Winkler sp.

(Plate X., fig. 27.)

Otodus rutoti, T. C. Winkler, 1876, Archiv. Mus. Teyler, vol. IV., pt. 1, p. 4, pl. I., figs. 3 and 4. Vincent, 1876, Ann. Soc. Malacol. Belg., vol. XI., p. 124, pl. VI., figs. 1*a-e*.

Odontaspis rutoti, Winkler sp., A. S. Woodward, 1899, Proc. Geol. Assoc., vol. XVI., p. 7, pl. I., figs. 10 and 11.

Odontaspis rutoti, Winkler, Leriche, 1902, Mem. Mus. roy. l'Hist. nat. Belg., vol. II., p. 21, 31, pl. I., figs. 37-44. Idem, 1906, Mem. Soc. géol. du Nord, vol. V., p. 115. Ameghino, 1906, Annales del Museo Nacional de Buenos Aires, ser. 3, vol. VIII., p. 184, 185, 505, pl. I., figs. 10 and 10*a*. Leriche, 1908, Ann. Soc. géol. du Nord, vol. XXXVII., p. 236, pl. III., figs. 13-22.

Odontaspis rutoti, Winkler sp., Chapman, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 14 and 15.

Observations.—Ameghino has suggested that the specimen of a shark's tooth from Waurn Ponds referred by Chapman and Pritchard in 1904 to *Lamna bronni* probably belongs to *Odontaspis rutoti*, Winkler sp., but the present authors are still of the opinion that the tooth was correctly identified as that of a *Lamna*. We have now the pleasure of recording a veritable *O. rutoti* from the Miocene (Janjukian) of Table Cape Tasmania. Hitherto the species *O. rutoti* has been recorded from the Lower Eocene in England and Belgium, but in all probability the Patagonian examples of Ameghino are distributed in a formation of later age.

The solitary example before us (here figured) shows the crown and a little more than half the base of the tooth, and has two well-developed lateral denticles while a third is smaller. In form and general characters it closely matches the figure given by Ameghino (*loc. supra cit.*). The original figures by Winkler show a rather broader crown, but the tooth is fundamentally the same as our specimen.

The bed from whence Ameghino's specimen came is the Lower Juléen, which is nearly at the base of the Patagonian formation. It might be mentioned in passing that associated with the Patagonian examples of *O. rutoti* is *Carcharodon megalodon* (recorded as *C. auriculatus* by Ameghino) which is also found at Table Cape. The echinoids, brachiopods and other shells also show affinities to our Janjukian, so that it is patent to us that the species ranges higher in the southern hemisphere.

Occurrence.—From the lower bed at Table Cape, Tasmania; Nat. Mus. Coll., pres. by F. A. Cudmore.

Genus **Lamna**, Cuvier. (Blue Pointer sharks.)

LAMNA APICULATA, Agassiz.

(Plate X., figs. 28, 29.)

Otodus apiculatus, Agassiz, 1843, Poiss. Foss., vol. III., p. 275, pl. XXXII., figs. 32-35.

Oxyrrhinus woodsii, McCoy, MS., T. Woods, 1862, Geol. Obs. S. Aust., p. 80, two figures.

Oxyrhina enysii, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 28, pl. V., figs. 17*a-c*, 18, 19 and 20.

Oxyrhina subvexa, Davis, 1888, ibid., p. 31, pl. VI., figs. 4*a-c*.

Lamna apiculata, Agassiz sp., Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 278. Chapman, 1914, Australasian Fossils, pages 268, 269, 271, fig. 130*d*. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 13, pl. V., figs. 17*a-c*, 18-20; pl. VI., figs. 4*a-c*.

Observations.—In a former paper it was remarked that the the Kalimnan specimens from Beaumaris were "all worn and probably derived from the Balcombian." We have noticed further the occurrence of several specimens from the same locality which are very well preserved, one being here figured. We are of the opinion that the bed from which they were derived is, if anything, not older than the Upper Miocene.

Additional Occurrence.—Janjukian. Filter Quarries, Batesford (T. S. Hall Coll.; also F. A. C. Coll.); Batesford (Nat. Mus. Coll., pres. by Mr. J. A. Tonks; also pres. by Mr. H. E. Henshaw); 60ft. down, Batesford (Nat. Mus. Coll., pres. by Mr. D. Culliney). Aust. Portland Cement Co. Quarry, Moorabool River (F. A. C. Coll.). Curlewis (Nat. Mus. Coll.). Meredith, Moorabool River (Nat. Mus. Coll., pres. by Mr. J. A. Kershaw). Limestones on township side of mouth of Spring Creek, Torquay (Nat. Mus. Coll., pres. by F. A. Cudmore). Lower beds, Bird Rock Cliffs, Torquay (Nat. Mus. Coll., pres. by F. A. Cudmore). Lower bed, Table Cape, Tasmania (Nat. Mus. Coll., pres. by F. A. Cudmore). Murray River Cliffs, at Morgan, South Australia (Nat. Mus. Coll., pres. by F. A. Cudmore); also 4 miles below Morgan (F. A. C. Coll.). Lower beds, Aldinga, South Australia (Nat. Mus. Coll., pres. by F. A. Cudmore).

LAMNA COMPRESSA, Agassiz.

Lamna compressa, Agassiz, 1843, Poiss. Foss., vol. III., p. 290, pl. XXXVII., figs. 35-42.

Lamna marginalis, Davis, (pars), 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 19, pl. III., figs. 8-10.

Lamna macrota, Agassiz (vel *compressa*), A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 402.

Odontaspis macrota, Agassiz sp., A. S. Woodward, 1899, Proc. Geol. Assoc., vol. XVI., p. 9, pl. I., figs. 19 and 20.

Lamna compressa, Agassiz, Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. I, p. 279. Chapman, 1914, Australasian Fossils, pages 269 and 271. Idem, 1916, Rec. Geol. Surv. Vict., vol. III., pt. 4, p. 338 and 379. Idem, 1918, N.Z., Geol. Surv., Pal. Bull. No. 7, p. 15, pl. II, figs. 8*a-c*, 9; pl. IX., figs. 6*a*, *b*, and 7.

Observations.—This species is remarkably rare compared with others of the same genus. We note that one of two additional specimens in the Nat. Mus. Coll., presented by Mr. J. A. Kershaw, F.E.S., Curator of the Nat. Mus., from Grange Burn is, unlike those previously recorded from the locality, remarkably well preserved.

Additional Occurrence.—Upper Pliocene. Limestone Creek (="*Oxyrhina* or *Lamna*" of Dennant); Nat. Mus. Coll. Janjukian. 60ft. down, Batesford (Nat. Mus. Coll., pres. by Mr. D. Culliney). From over 400ft. down and near the bottom of the bore for water in the yards at the abbattoirs in 1919, at Croydon, near Adelaide, S. Australia (Nat. Mus. Coll., pres. by F. A. Cudmore).

LAMNA CRASSIDENS, Agassiz.

Lamna crassidens, Agassiz, 1843, Poiss. Foss., vol. III., p. 292, pl. XXXV., figs. 8--21.

Odontaspis (?) *crassidens*, Agassiz sp., A. S. Woodward, 1889, Cat. Foss., Fishes, Brit. Mus., pt. 1, p. 373.

Lamna crassidens, Agassiz, Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 278. Chapman, 1914, Australasian Fossils, p. 269. Priem, 1914, Bull. Soc. géol. France, ser. 4, vol. XIV., p. 378, 380, 382.

Additional Occurrence.—Kalimnan. Beaumaris (Nat. Mus. Coll., pres. by F. A. Cudmore). Janjukian. A second specimen from Waurn Ponds (Nat. Mus. Coll., pres. by the late Mr. W. Nelson).

LAMNA BRONNI, Agassiz.

Lamna (*Odontaspis*) *bronni*, Agassiz, 1843, Poiss. Foss., vol. III., p. 297, pl. XXXVIIa., figs. 8-10.

Odontaspis acuta, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 22, pl. V., figs. 1 and 2.

Odontaspis bronni, Agassiz, A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 360. Idem, 1891, Geol. Mag., dec. 3, vol. VIII., p. III.

Lamna bronni, Agassiz, Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 279. Chapman, 1914, Australasian Fossils, p. 269. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 14, pl. V., figs. 1*a*, 1*b*, 2*a-c*; pl. VIII., fig. 3.

Observations.—It is of interest to note that this species occurs in New Zealand in beds of Miocene age, as has been shown by Chapman (*loc. supra cit.*). No additional specimens have occurred since the one referred to in 1904, which is in the Pritchard Coll.

Genus **Isurus**, Rafinesque. (Blue Pointer sharks.)

ISURUS HASTALIS, Agassiz sp.

(Plate X., fig. 30.)

Oxyrhina hastalis, Agassis, 1843, Poiss. Foss., vol. III., p. 277, pl. XXXIV., figs. 3-13, 15-17.

Oxyrhina xiphodon, Agassiz, 1843, ibid., p. 278, pl. XXXIII., figs. 11-17.

Oxyrhina trigonodon, Agassiz, 1843, ibid., p. 279, pl. XXXVII., figs. 17, 18.

Oxyrhina plicatilis, Agassiz, 1843, ibid., p. 279, pl. XXXVII., figs. 14, 15.

Oxyrhina acuminata, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 29, pl. V., figs. 21*a-c*.

(?) *Oxyrhina lata*, Davis, 1888, ibid., p. 32, pl. VI., fig. 5.

Oxyrhina hastalis, Agassiz, A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 385. L. Seguenza, 1900, Boll. Soc. Geol. Ital., vol. XIX., p. 484, pl VI., figs. 23-28. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 280, pl. XI., figs. 12-14. Eastman, 1904, Maryland Geol. Surv. Miocene, p. 80, pl. XXX., figs. 5*a*, *b*, 6*a-c*. Ameghino, 1906, Anales del Museo Nacional de Buenos Aires, ser. 3, vol. VIII., p. 179, pl. I., figs. 16, 16*a*, 16*c*, 16*i*. Leriche, 1908, Anales Soc. géol. du Nord, vol. XXXVII., p. 303. Chapman, 1914, Australasian Fossils, p. 268, 269, 271, fig. 130*c*.

Isurus hastalis, Agassiz sp., Chapman, 1917, Victorian Naturalist, vol. XXXIV., No. 8, p. 128. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 17, pl. V., figs. 21 *a-c*; pl. VI., fig. 5. Jordan and Gilbert (pars), 1919, Foss. Fishes South. Calif., Stanford Univ., California, pt. 2, pl. VIII., figs. A, B, and H.

Observations.—Although many additional occurrences are here recorded, the range from Balcombian to Kalimnan remains the same. We have had some little difficulty in separating the teeth of *Isurus hastalis* from those of *Lamna apiculata* which have lost their lateral denticles, but the latter may be distinguished by the relatively greater median thickness along the vertical axis. The colouration in the teeth of *I. hastalis* varies remarkably from blue to brown and yellow. One of the most handsome *I. hastalis* we have seen was collected by the late Dr. T. S. Hall from Murghebuloc, near Geelong. This tooth has a length from base to apex of crown of 75mm., whilst the width at the base is 47mm. The greatest thickness of the tooth is 12.5mm. The shape is elongate triangular, slightly obliquely curved, with the sharp enamel edge of a razor-like

keenness. The colour varies from bluish grey in the centre of the tooth passing into a dark bluish grey towards the edges and apex. The vasodentinal structure is well preserved and shows the openings to the canals as perfectly as in a recent specimen.

Additional Occurrence.—Kalimnan. Black Rock (T. S. Hall Coll.). Janjukian. Aust. Portland Cement Co. Quarry, Moorabool River, near Geelong (F. A. C. Coll.). Section IV*a*., Murgheboluc, near Geelong (Nat. Mus. Coll., from T. S. Hall Coll., pres. by F. A. Cudmore). Bullenmerri, near Camperdown (T. S. Hall Coll.). L. Keilambete, near Colac (Nat. Mus. Coll., col. and pres. by Mr. R. H. Walcott). South Yarra, Melbourne (Nat. Mus. Coll., pres. by the late Mr. W. B. Jennings). 4 miles below Morgan, Murray River Cliffs, South Australia (F. A. C. Coll.). Balcombian. From yellow clays at Grice's Creek (F. A. C. Coll.); also from the shingle on beach where Balcombian clays rest on granite about a mile south of Grice's Creek (F. A. C. Coll.).

Isurus retroflexus, Agassiz sp.

(Plate X., fig. 31.)

Oxyrhina retroflexa, Agassiz, 1843, Poiss. Foss., vol. III., p. 281, pl. XXXIII., fig. 10.

Oxyrhina crassa, Agassiz, 1843, ibid., vol. III., p. 283, pl. XXXVII., fig. 16.

Oxyrhina vonhaastii, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 26, pl. IV., figs. 1, 2 (non fig. 3).

Oxyrhina recta, Davis, 1888, ibid., p. 27, pl. V., fig. 14.

Oxyrhina crassa, Agassiz, A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 389.

Oxyrhina retroflexa, Agassiz, Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 282. Chapman, 1914, Australasian Fossils, p. 269 and 271.

Isurus retroflexus, Agassiz, sp., Chapman, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 18, pl. IV., figs. 1, 2*a-c*.

Observations.—A number of new localities are here recorded. The range of this form as at present known, is Janjukian to Kalimnan. There is a magnificent block of Batesford limestone in the National Museum which contains no less than twenty-eight teeth of this species and one tooth of *Carcharodon megalodon*, Charlesworth. It measures twelve by seventeen inches. It is known that several specimens had been extracted by persons interested before it came into the possession of the National Museum, to which it was presented by Mr. W. B. McCann, when the unique value of it was pointed out by one of us (F.C.), while on a holiday in the Geelong district. The great variation in the teeth of a single species is here shown, some of them being of the typical *vonhaasti* form of New Zealand in their strongly curved crown and prolonged roots.

Additional Occurrence.—Janjukian. Bird Rock Cliffs, Torquay (Nat. Mus. Coll., pres. by Mr. W. J. Harris, also by F. A. Cudmore; T. S. Hall Coll.). Waurn Ponds (Nat. Mus. Coll., pres. by Mr. W. Nelson; also T. S. Hall Coll.). Batesford (Nat. Mus. Coll.); Filter Quarries, Batesford (Nat. Mus. Coll., from T. S. Hall Coll., pres. by F. A. Cudmore). Rutledge's, near Geelong (T. S. Hall Coll.). Aust. Portland Cement Co. Quarry, Moorabool River (F. A. C. Coll.). Lower bed, Table Cape, Tasmania (F. A. C. Coll.). Upper strata of Janjukian age at Morgan, Murray River Cliffs, S. Australia (Nat. Mus. Coll., pres. by F. A. Cudmore); also 4 miles below Morgan (low river level), S.A. (F. A. C. Coll.). Curlewis (Nat. Mus. Coll., collected by Mr. R. H. Annear). Flinders (Nat. Mus. Coll., pres. by Mrs. W. D. Gleadall). Green Gully, Keilor, near Melbourne (Miss Irene Crespin Coll.). Filter Quarries, Batesford (Nat. Mus. Coll., pres. by Mr. W. B. McCann).

Isurus eocaenus, A. S. Woodward, sp.

Carcharias (Scolidon) eocaenus, A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 436.

Oxyrhina eocaena, A. S. Woodward, 1900, Proc. Geol. Assoc., vol. XVI., p. 11, pl. I., figs. 25, 26. Chapman, 1914, Australasian Fossils, p. 271. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1., p. 282.

Additional Occurrence.—Janjukian. Curlewis (Nat. Mus. Coll., coll. by Mr. R. H. Annear). 4 miles below Morgan, Murray River Cliffs, South Australia (F. A. C. Coll.).

Isurus minutus, Agassiz sp.

Oxyrhina minuta, Agassiz, 1843, Poiss. Foss., vol III., p. 285, pl. XXXVI., figs. 39-47. Sismonda, 1849, Mem. R. Acad. Sci. Torino, ser. 2, vol. X., p. 44, pl. II., figs. 36-39. O. G. Costa, 1854, Palaeont. Regno. Napoli, pt. 2, p. 85, pl. VII., figs. 52-58.

Oxyrhina fastigiata, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 30, pl. VI., figs. 1-3.

Oxyrhina minuta, Agassiz sp., Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII, (N.S.), pt. 1, p. 283. Chapman, 1914, Australasian Fossils, pp. 269-271. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 17, pl. VI., figs. 1*a-c*, 2, 3.

Additional Occurrence.—Janjukian. Bird Rock Cliffs, Torquay (F. Chapman Coll.). Filter Quarries, Batesford (T. S. Hall Coll., pres. Nat. Mus. by F. A. Cudmore). Upper bed, Table Cape (Nat. Mus. Coll., pres. by F. A. Cudmore). Kalimnan. Beaumaris (Nat. Mus. Coll., pres. by F. A. Cudmore).

ISURUS DESORII, Agassiz sp.

(Plate X., fig. 32.)

Oxyrhina desorii, Agassiz, 1843, Poiss. Foss., vol. III., p. 202, pl. XXXVII., figs. 8-13.

Oxyrhina leptodon, Agassiz, 1843, ibid., p. 282, pl. XXXVII., figs. 3-5.

Oxyrhina grandis, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 30, pl. V., figs. 15, 16.

Oxyrhina desorii, Agassiz, A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 382. Idem, 1891, Geol. Mag., dec. 3, vol. VIII., p. 106. L. Seguenza, 1900, Boll. Soc. Geol. Ital., p. 482, pl. V., figs. 1-12. Leriche, 1902, Mem. Mus. d'Hist. nat. Belg., vol. V., p. 275, pl. XVI., figs. 16-31. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol XVII. (N.S.), pt. 1, p. 281. Eastman, 1904, Maryland Geol. Surv. Miocene, p. 79, pl. XXX., fig. 4. Leriche, 1906, Ann. Soc. géol. du Nord, vol. XXXV., p. 299, Idem, 1906, ibid., p. 353, 355.

Isurus (?) *desorii*, Agassiz, Jordan, 1907, Univ. Calif. Publ. Geol. Bull., vol. V., No. 7, p. 112.

Oxyrhina desori (Agassiz), Sismonda, Leriche, 1910, Anales Soc. géol. du Nord, p. 330, pl. III., figs. 14, 15.

Oxyrhina desori, Agassiz, Chapman, 1914, Australasian Fossils, p. 269, 271, Priem, Bull. Soc. Géol. France, ser. 4, vol. XIV., p. 374, 378, 380, 387. *Isurus desori*, Ag. sp., Chapman, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 16, pl. V., figs. 15*a-c*, 16*a-c*.

Observations.—Although not abundant in the Victorian Tertiary beds, *Isurus desorii* is well distributed in both the Janjukian and the Kalimnan. In Europe and North America it appears as early as the Lower Eocene, and there is a doubtful Upper Cretaceous record from California by Jordan. It occurs doubtfully in the New Zealand Upper Cretaceous (Danian) but is typically represented there from the Eocene to Miocene. The characters of this species are fairly distinct: thus the base is broader than in *I. retroflexus* and is generally midway in shape between that species and *I. hastalis*. The crown is more elongately triangular than in *I. hastalis*, and is more depressed on the inner surface than in *I. retroflexus*. One of the specimens from the Kalimnan of Grange Burn shows, on the outer coronal face, perforations near the surface caused by what appears to be the reticulum of a boring sponge.

Additional Occurrence.—Bird Rock Cliffs, Torquay (Nat. Mus. Coll., from T. S. Hall Coll., pres. by F. A. Cudmore). Clyde Quarries, Moorabool River (Nat. Mus. Coll. from T. S. Hall Coll., pres.

by F. A. Cudmore). Kawarren Limestone Quarries, Beech Forest (Nat. Mus. Coll., pres. by Mr. A. Short.

Genus **Carcharodon**, Müller and Henle.

CARCHARODON MEGALODON, Charlesworth.

Carcharodon megalodon, Charlesworth (ex. Ag. MS.), 1837, Mag. Nat. Hist., vol. I., p. 225, woodc. fig. 24.

Carcharodon megalodon, Agassiz, 1843, Poiss. Foss., vol. III., p. 247, pl. XXIX.

Carcharodon rectidens, Agassiz, 1843, ibid., p. 250, pl. XXXa., fig. 10.

Carcharodon subauriculatus, Agassiz, 1843, ibid., p. 251, pl. XXXa., figs. 11-13.

Carcharodon productus, Agassiz, 1843, ibid., p. 251, pl. XXX., figs. 2, 4, 6-8.

Carcharodon polygyrus, Agassiz, 1843, ibid., p. 253, pl. XXX., figs. 9-12.

Carcharodon megalodon, Agassiz, Gibbes, 1848, Journ. Acad. Nat. Sci. Philad., ser. 2, vol. I., p. 143, pl. XVIII; pl. XIX., figs. 8, 9. McCoy, 1875, Prod. Pal. Vict., dec. 2, pl. XI., fig. 4. Martin, 1887, Samml. Geol. Reichs-Mus. Leiden, ser. 1, vol. III., p. 23, pl. I., fig. 12. Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 12, pl. II., figs. 1-3. A. S. Woodward, 1889, Cat. Foss. Fishes. Brit. Mus., pt. 1, p. 415. L. Seguenza, 1900, Boll. Soc. Geol. Ital., vol. XIX., p. 503, pl. VI., figs. 1-3. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 284.

Carcharodon megalodon, Charlesworth sp., Eastman, 1904, Maryland Geol. Surv. Miocene, p. 82, pl. XXXI., figs. 1*a-c*, 2, 3, 4*a*, 4*b*. Jordan, 1905, Guide to the Study of Fishes, vol. 1., p. 539, fig. 332. Ameghino, 1906, Anales del Museo Nacional de Buenos Aires, ser. 3, vol. VIII., p. 181, fig. 48; pl. II., figs. 21, 21*a*, 21*c*, 22, 22*a*.

Carcharodon chubutensis, Ameghino, 1906, ibid., p. 181, fig. 49.

Carcharodon branneri, Jordan, 1907, Univ. Calif. Publ. Bull. Dept. Geol., vol. V., No. 7, p. 116, fig. 15.

Carcharodon megalodon, Agassiz, Leriche, 1908, Ann. Soc. géol. du Nord, vol. XXXVII., p. 304. Chapman 1914, Australasian Fossils, pages 269, 270, 271. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 19, pl. II., figs. 1*a-c*, 2*a-c*, and 3.

Observations.—We have examined a large tooth from Neumerella, near Orbost, which is nearly equal in size to some gigantic examples from Muddy Creek, Victoria. The height of this tooth

is 115mm., and the width of the root is 90mm. Another tooth of interest, from Beaumaris, has a very undeveloped crown, but the root is large and of abnormal shape and seems to indicate an anterior tooth. In its general form and depressed crown it might easily be mistaken for a species of the Cretaceous genus *Corax*. Height of tooth, 15.5mm.; width of base, 30mm.; (Nat. Mus. Coll., presented by F. A. Cudmore).

Additional Occurrence.—Janjukian. Neumerella, near Orbost, East Gippsland (Nat. Mus. Coll., purchased from Mr. A. Taylor). This specimen came from a railway cutting two miles from Orbost. Batesford, near Geelong (Nat. Mus. Coll., pres. by Mr. J. A. Tonks). Table Cape, Tasmania (Nat. Mus. Coll., pres. by Mr. C. Thatcher).

CARCHARODON AURICULATUS, Blainville sp.

Squalus auriculatus, de Blainville, 1818, Nouv. Dict. d'Hist. Nat., vol. XXVII., p. 384.

Carcharodon auriculatus, Agassiz, 1843, Poiss. Foss., vol. III., p. 254, pl. XXVIII., figs 17-19.

Carcharodon angustidens, Agassiz, 1843, ibid., p. 255, pl. XXVIII., figs. 20-25; pl. XXX., figs. 2, 3. McCoy, 1875, Prod. Pal. Vict., dec. 2, p. 8, pl. XI., figs. 2, 3. Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 9, pl. I., figs. 4-6, non pl. VI., fig. 22.

Carcharodon robustus, Davis, ibid., p. 13, pl. I., fig. 7.

Carcharodon auriculatus, Blainville sp., A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 411. Idem, 1899, Proc. Geol. Assoc., vol. XVI., p. 11. L. Seguenza, 1900, Boll. Soc. Geol. Ital., vol XIX., p. 501, pl. V., figs. 14-18. Eastman, 1901, Maryland Geol. Surv. Eocene, p. 108. Chapman and Pritchard, 1904, Proc. Roy. Soc. Vict., vol. XVII. (N.S.), pt. 1, p. 283.

Carcharodon angustidens, Agassiz, Priem, 1906, Bull. Soc. géol. France, ser. 4, vol. VI., p. 199, pl. VIII., figs. 14, 15. Leriche, 1910, Anales Soc. géol. du Nord, vol. XXXIX., p. 330.

Carcharodon auriculatus, Blainville sp., Chapman, 1914, Australasian Fossils, p. 268, 269, 271, fig. 130*e*. Priem, 1914, Bull. Soc. géol. France, ser. 4, vol. XIV., p. 374, 380.

Carcharodon robustus, Davis, Chapman, 1914, ibid., p. 269.

Carcharodon auriculatus, Blainville sp., Chapman, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 18, pl. I., figs. 4*a-c*, 5, 6, 7*a-c*.

Observations.—An exceptionally large specimen of *Carcharodon auriculatus* from the Janjukian of Table Cape (lower bed), Tasmania (Nat. Mus. Coll., pres. by F. A. Cudmore), is equal in size to some

small teeth of *C. megalodon*, but differs in the narrower crown. The length of this tooth, point to base of root is 91.5mm.; width at base of crown, 54.5mm.; approximate width at root, when complete, 59mm. The serrations on the edge of this specimen number 98, 17 of them being on the side denticle near the base.

C. auriculatus was recorded by one of us from the Mallee Bores; the specimens, however, prove not to be this species and the record must be amended (see Chapman, 1916, Rec. Geol. Surv. Vict., vol. III., pt. 4, p. 349, 353, and *antea* p. 14).

Additional Occurrence.—Kalimnan. A well-preserved specimen from Beaumaris; Nat. Mus. Coll., collected by Mr. H. Mathias.

CARCHARODON CARCHARIAS, Linné sp. (Great White Shark.)

Squalus carcharias, Linné, 1758, Syst. Naturae, ed. 10, p. 235.

Carcharodon rondeletii, Müller and Henle, 1841, Syst. Beschreib. Plagiostom, p. 70.

Carcharodon sulcidens, Agassiz, 1843, Poiss Foss., vol. III., p. 254, pl. XXX*a*., figs. 3-7.

Carcharodon rondeletii, Müller and Henle, McCoy, 1882, Prod. Zool., vol. I., dec. 8, p. 19, pl. LXXIV.

Carcharodon angustidens, Agassiz, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 9, pl. VI., fig. 22.

Carcharodon rondeletii, Müller and Henle, A. S. Woodward, 1889, Cat. Foss. Fishes, Brit. Mus., pt. 1, p. 420.

Carcharodon carcharias, Linné, Hutton, 1904, Index Faunae novo-zelandiae, p. 54. Waite, 1904, Mem. N.S.W. Nat. Hist. Club, No. 2, p. 8.

Carcharodon rondeletii, Müller and Henle, E. Ray Lankester, 1906, Extinct Animals, p. 264, 266, fig. 192.

Carcharodon carcharias, Linné Waite, 1907, Rec. Cant. Mus., vol. I., No. 1, p. 6.

Carcharodon arnoldi, Jordan, 1907, Univ. Calif. Publ. Geol. Bull. vol. V., No. 7, p. 114, fig. 13.

Carcharodon riversi, Jordan (pars), 1907, ibid., p. 115, fig. 14*a*, (non fig. 14*b*).

Carcharodon rondeletii, Müller and Henle, Leriche, 1908, Soc. géol. du Nord, vol. XXXVII., p. 304.

Carcharodon carcharias, Linné, Jordan, Tanaka and Snyder, 1913, Cat. Fishes Japan, p. 16.

Carcharodon rondeletii, Müller and Henle, Chapman, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 20, pl. VI., fig. 22; pl. VIII., figs. 1, 2.

Observations.—The edge of the tooth in most of the specimens is gently concave, but in one from between Cowie's Creek and Duck

Ponds, Geelong, the edge near the apex is slightly convex. The teeth of this species are readily distinguished from the older forms like *C. auriculatus* and *C. megalodon* by the distinctly depressed internal surface of the crown. The denticulations also are square-ended and not so deeply incised. It is interesting to note the occurrence of this living species from the Kalimnan. A specimen from the Pleistocene of the West Melbourne Swamp gives the following measurements: height of tooth, 43mm.; width of base, 30mm.

Occurrence.—Pleistocene. West Melbourne Swamp (Nat. Mus. Coll., pres. by Mr. J. H. Gatliff). Between Cowie's Creek and Duck Ponds, Geelong (Nat. Mus. Coll., purchased from Mr. N. Taylor). Kalimnan. Beaumaris (Nat. Mus. Coll., pres. by Mr. H. Mathias). Grange Burn, near Hamilton (Nat. Mus. Coll., pres. by Mr. S. F. Mann).

Family SQUATINIDAE, Müller and Henle.

Genus **Squatina**, Aldrovandi. (Angel-fishes or Monk-fishes.)

SQUATINA GIPPSLANDICUS, sp. nov.

(Plate XI., fig. 47.)

Description.—Tooth strong, somewhat recurved and sharply pointed crown; outer face convex, inner face convex; medially depressed; cutting edges sharp. Base thick, triangular, not so laterally extended as in the living *Squatina squatina*, Linné. Basal view of tooth triangular with a median projection on the inner margin representing the median fold on the inner face of the crown.

Dimensions.—Height of tooth, 11mm.; width at base, 5.5mm.; diameter of base from inner to outer surface, 5mm. Holotype.

Observations.—Compared with the living *Squatina squatina*, the tooth of this species has a longer or higher crown and its flexure is more marked. The base is not so widely extended, owing probably to disintegration, but the generic character of the basal median projection of the crown into the root is very marked. Fossil forms such as that described by Winkler[6] as *Squatina prima* from the Eocene of Belgium have a more extended base and thereby accord more closely with the living species. Probably the nearest related fossil species is *Squatina occidentalis*, Eastman[7] from the Miocene of Plum Point, Maryland; this species, however, differs in having a shorter crown, though the base in its less extent is nearer to the Gippsland fossil species than the European ones. Another species, figured by Ameghino from the Patagonian Tertiaries, namely *S. gigantea*,[8] differs considerably from the present in having a short

6.—*Trigonodus primus* Winkler, 1876, p. 13, pl. i., figs. 18-21.
Squatina prima, Winkler, Leriche, 1902, p. 16, 28, pl. i., figs. 17-22. Idem, 1905, p. 72, 96, 177, pl. iv., figs. 3-5. Idem, 1906, p. 112, 141, 161, 176, 177, pl. vii., figs. 3-5. Idem, 1908,[2] p. 230, pl. iii., figs. 1-5.
7.—1904, p. 71, pl. xxviii., figs. 1*a*, 1*b*.
8.—1906, p. 178, 183, text figs. 45*a*, 45*e*, 45*f*.

heavy crown and extended base. *Trigonodus secundus*, Winkler[9] from the Lower Eocene of Belgium, is a stouter type of tooth but shows a considerable likeness to ours in the flexure of the crown. In the greater height of the crown of *S. gippslandicus* one is at first sight liable to confuse it with *Odontaspis*, but the character of the base is very distinct from that genus.

The occurrence of this genus in the Victorian Miocene is interesting from the fact that it has not been previously recorded as fossil from the Australian region.

Occurrence.—Janjukian. Neumerella, near Orbost, East Gippsland. This was discovered by one of us (F.C.) whilst on a collecting expedition to Neumerella railway workings in 1915. Nat. Mus. Coll.

Family PRISTIOPHORIDAE, Günther.

Genus **Pristiophorus**, Müller and Henle. (Saw shark.)

PRISTIOPHORUS LANCEOLATUS, Davis sp.

(Plate X., fig. 33.)

Lamna lanceolata, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 20, pl. III., figs. 12*a-d*.

Pristiophorus lanceolatus, Davis sp., Chapman, 1917, Proc. Roy. Soc. Vict., vol. XXIX. (N.S.), pt. 2, p. 137, pl. IX., fig. 5. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 20, pl. III., figs. 12*a-d*; pl. IX., fig. 8.

Observations.—In addition to the previous occurrence of this species, it is interesting to record some other specimens which have been recently found. The specimen occurring at Batesford is a typical rostral tooth which has been partially bored by a bone-infesting fungus; this discovery extends the range of the species in Victoria down to the Miocene (Janjukian). For the first time an oral tooth of this species has to be recorded, one having occurred in the Kalimnan beds at Beaumaris (Nat. Mus. Coll., pres. by F. A. Cudmore). Several further rostral teeth have been found at this locality.

Additional Occurrence.—Kalimnan. McDonald's, Muddy Creek, near Hamilton (Nat. Mus. Coll., pres. by F. A. Cudmore). Janjukian. Batesford (Nat. Mus. Coll., from T. S. Hall Coll., pres. by F. A. Cudmore).

Family PRISTIDAE, Günther.

Genus **Pristis**, Latham. (Saw-fishes.)

PRISTIS CUDMOREI, Chapman.

Pristis cudmorei, Chapman 1917, Proc. Roy. Soc. Vict., vol. XXIX. (N.S.), pt. 2, p. 139, pl. IX., fig. 7.

Observations.—Several further specimens have been found at Beaumaris.

9.—1876, p. 20, pl. ii., figs. 4, 5.

PRISTIS RECURVIDENS, sp. nov.

(Plate X., figs. 34, 35.)

Description (Rostral teeth).—Description of Holotype. Tooth of moderate size compared with living forms; flattened elongate, acuminate, with a sinuous twist or recurving of the tooth towards the apex. The concave edge of the tooth is rounded; the convex and incurved opposite margin is keeled and distinctly sulcated on either face of the keel. Base flattened, oval, and depressed.

Dimensions of Holotype.—Length, 14mm.; width of base, 4.5 mm.; greatest thickness of base, 2mm. Upper bed, Table Cape.

Dimensions of Paratype.—Length, 16mm.; width of base, 5.5 mm.; greatest thickness of base, 3.5mm. Lower bed, Table Cape.

Observations.—The colour of the Table Cape specimens, in common with other fish teeth found in these beds, is of a dark bluish to black, probably owing to the mineralised condition in vivianite. A specimen from the Murray River Cliffs, on the other hand, is quite bleached and is of a pale bone colour.

The above species shows a marked distinction from *P. cudmorei* in its recurved apex, in the keeled convex edge, and in the consequent oval outline in cross-section. We have carefully compared the rostral teeth of recent species, in which we have been kindly assisted by Mr. J. A. Kershaw, F.E.S., Curator of the National Museum, and have come to the conclusion that the variation seen in these living forms does not admit such a departure from the type already known to us as *P. cudmorei* as to warrant our placing the present type of tooth with that species.

Occurrence.—Kalimnan. Beaumaris (Nat. Mus. Coll., pres. by F. A. Cudmore). Janjukian. Wood's Flat, Murray River Cliffs, South Australia (Nat. Mus. Coll., pres. by F. A. Cudmore). Upper and lower beds, Table Cape, Tasmania (Nat. Mus. Coll., pres. by F. A. Cudmore).

Family TRYGONIDAE, Müller and Henle.

Genus **Trygon.** Adanson. (Sting-rays.)

TRYGON CF. RUGOSUS, Probst sp.

Trygon cf. rugosus, Probst sp., Chapman, 1916, Rec. Geol. Surv. Vict., vol. III., pt. 4, p. 341, 389, pl. LXXVI., fig. 56*a-d*.

Observations.—No further record of this species has been made.

Family MYLIOBATIDAE, Müller and Henle.

Genus **Myliobatis,** Cuvier. (Eagle-rays.)

MYLIOBATIS MOORABBINENSIS, Chapman and Pritchard.

Myliobatis moorabbinensis, Chapman and Pritchard, 1907, Proc. Roy. Soc. Vict., vol. XX. (N.S.), pt. 1, p. 60, pl. V., figs. 1-3. Chapman, 1917, Proc. Roy. Soc. Vict., vol. XXIX. (N.S.), pt. 2, p. 139, pl. IX., fig. 8.

Observations.—This species remains a restricted Kalimnan form, since some previous records (op. cit.[10]) have been transferred to a new species (*M. affinis*).

Caudal spines: only fragments found; comparable in their form and ornament with the living *M. australis*, Macleay, but differing in the greater compression of the spine (Nat. Mus. Coll., presented by F. A. Cudmore). Locality: Beaumaris.

MYLIOBATIS AFFINIS, sp. nov.

(Plate X., fig. 36.)

Myliobatis moorabbinensis, pars., Chapman, 1914 (non Chapman and Pritchard, 1904), Proc. Roy. Soc. Vict., vol. XXVII. (N.S.), pt. 1, p. 57, pl. X., fig. 57. Idem, 1916, Rec. Geol. Surv. Vict., p. 339, 353, 355, pl. LXXVI., fig. 57. Idem, 1917, Proc. Roy. Soc. Vict., vol XXIX. (N.S.), pt. 2, p. 139, pl. IX., fig. 8.

Description.—Teeth of median series narrow; marginal articulating ridges thin and sharp; transverse ridges of the inferior surface thin and short. Twelve to fifteen ridges in the space of ten millimetres.

Dimensions.—Holotype from Mallee Bores (Bore 10, 225-230 ft.): Length, 18mm.; width, 5.75mm.; thickness, 2mm.

Paratype from upper beds, Table Cape: Length, 18.5 mm.; width, 4.5mm.; thickness, 2mm.

Paratype from Bird Rock Cliffs, Torquay. Length, 27mm.; width, 6.75mm.; thickness, 2.25mm.

Observations.—The present size and form of the median teeth of this species show it to be usually smaller than *M. moorabbinensis*, whilst the transverse denticulate ridges are more numerous than in that species. The record of *M. plicatilis*, Davis, a New Zealand species, listed by Dennant and Kitson from Table Cape, Tasmania[11], we venture to presume is identical with the above species since no specimens have come under our observation which show the breadth of the the New Zealand form.

It will be seen by the above synonymy that the specimens from Bird Rock Cliffs, Torquay, described by one of us in 1917, we now transfer to this new species (*M. affinis*) under which it stands as a paratype. In the 1917 paper some specimens from the borings in the Mallee were also referred to *M. moorabbinensis*, but they have now been relegated to the above new species.

Occurrence.—Kalimnan. Beaumaris (Nat. Mus. Coll., pres. by F. A. Cudmore). Mallee Bores (Bore 10, 225-230ft.), Nat. Mus. Coll. Janjukian. Paratype from Bird Rock Cliffs, Torquay (Nat. Mus. Coll., pres. by Mr. W. J. Parr). Paratype from upper beds,

10.—Chapman & Gabriel, 1914, p. 57, pl. x., fig. 57. Chapman, 1916, p. 339, 353, 355, pl. lxxvi., fig. 57.

11.—1903, p. 94.

Table Cape, Tasmania (Nat. Mus. Coll., pres. by F. A. Cudmore). From the Mallee Bores (Bore 4, 163-170ft.; Bore 9, 315-325ft.), Nat. Mus. Coll.

MYLIOBATIS PRENTICEI, SP. NOV.

(Plate X., fig. 37.)

Description.—Fragment of a caudal spine. The spine, when complete, appears to have tapered more rapidly and therefore to have been much shorter than that of the living *M. australis*, Macleay. The back or upper surface of the spine is more roundly convex and smoother than in the living species, whilst the under surface is more deeply grooved and even more so than in the living and the Kalimnan species, *M. moorabbinensis*. The lateral denticles of the present species are much coarser and stronger than in the living form, and their distal edges are more distinctly serrate. In the living species the denticles number about six in ten millimetres of length, whereas in *M. prenticei* there are five.

Dimensions.—Length of fragment, 15mm.; width at widest end, 6.5mm.; width at narrowest end, 4mm.; greatest thickness, 3mm.

Occurrence.—Janjukian. Waurn Ponds. Collected and presented to the National Museum by Mr. H. J. Prentice, after whom we name the specimen in recognition of his enthusiastic and successful collecting.

MYLIOBATIS TENUICAUDATUS, Hector. (Eagle Ray).

Myliobatis tenuicaudatus, Hector, T.N.Z. Inst., vol. IX., 1877, p. 468, pl. X; Idem, Mem. Harv. Mus. Comp. Zool., vol. XXXVI., 1913, p. 433.

Myliobatis australis, Macleay, P.L.S., N.S.W., vol. VI., 1881, p. 380; McCoy, Prod. Zool. Vict., dec. VII., 1882, pl. LXIII.

Myliobatis tenuicaudatus, Hector, 1921, Waite, Rec. S. Aus. Mus., vol. II., No. 1, p. 34, fig. 48.

Observations.—Both the caudal spines and the palatal teeth of the living Eagle Ray are found in the Pleistocene of the vicinity of Melbourne. They are well preserved, and are identical with those structures in the recent examples.

Occurrence.—Holocene. New Canal Cutting, between Wharf and Fishermen's Bend, Williamstown, depth about 25ft. Nat. Mus. Coll., pres. by Mr. F. McKnight. Spine behind dorsal fin. Pleistocene. West Melbourne Swamp; Mr. W. Kershaw Coll. in Nat. Museum. Also a caudal spine from the same locality; Nat. Mus. Coll. pres. by the late Mr. F. P. Spry. The Kershaw Coll. includes examples of the palatal teeth from West Melbourne Swamp.

Order HOLOCEPHALI. (Chimaeras).

Family CHIMAERIDAE.

Genus **Edaphodon**, Buckland. (Elephant fish.)

EDAPHODON SWEETI, Chapman and Pritchard.

(Plate XI., fig. 38, 39.)

Edaphodon sweeti, Chapman and Pritchard, 1907, Proc. Roy. Soc. Vict., vol. XX. (N.S.), pt. 1, p. 61, pl. V., figs. 4-6.

Observations.—From the numerous specimens now in the Collection it is seen that there is a great variation in the mode of preservation of the tritors especially of the vomerine or pre-maxillary bones. There may, indeed, be more than one species besides that described below, but of this we are not yet certain as the material is insufficient for determining the point. We are now figuring a well preserved right palatine from Grange Burn, which Mr. S. F. Mann kindly allowed us to select from a large number of his fossils, and this specimen shows in its comparative shortness its distinction from *E. prenticei*. Another specimen figured and from a new locality, Black Rock, is a pre-maxilla in which the small tritors are very well seen.

Additional Occurrence.—Black Rock (Nat. Mus. Coll., presented by Miss Hilda Neal). From the shingle, presumably derived from the Kalimnan.

EDAPHODON MIRABILIS, sp. nov.

(Plate XI., fig. 40.)

Description.—Holotype based on a right palatine or maxilla. The maxillary bone is very massive as compared with the other Australian fossil form (*E. sweeti*). The symphysial surface is perfectly flat and even. The external surface bears shallow furrows running parallel with the upper anterior margin. The tritors in the specimen pass vertically through the lower to the upper surface of the maxilla, and as the specimen is worn, the superior surface is hollowed out in the tritor-bearing region. The tritors are arranged in the typical manner of *Edaphodon* and are three in number, two inner and one outer (median). The largest is the internal posterior tritor which is bean-shaped or obovate; the internal anterior tritor is paraboloid in form, truncated posteriorly. The external tritor is narrowly oval. The shape of the maxillary bone viewed from the palatal surface is long, triangular, and produced at the outer posterior angle. The outer margin is obliquely directed towards the front of the maxillary bone. The anterior tritor is stepped or re-entrantly angulate against the large posterior internal tritor. The bony structure of the maxillary has an open osseous structure. The tritors are of the typical character, with the medullary canals numerous and projecting above the surface.

Dimensions.—Length of maxilla, 139mm.; greatest width on oval surface, 56mm.; width close to the anterior rounded extremity, 28mm.; greatest height at the posterior end of the maxillary, 49 mm.; length of posterior internal tritor, 51mm.; width, 28mm.; length of anterior internal tritor, 27mm.; width, 16mm.; length of external tritor, 22mm.; width, 8mm.

Observations.—This remarkable specimen differs from the corresponding palatines of *E. sweeti* in its massive proportions and elongated form. It is noteworthy that the nearest species to *E. mirabilis*, both as regards form and position of the tritors, is *E. crassus*, Newton[1], a species which is common in the Cambridge phosphatic deposits and the Upper Greensand of Warminster, and of which a fragment has also been found from the Lower Chalk of Lewes. These English deposits give a range of Albian—Cenomanian—Turonian (Cretaceous). Although the occurrence of gigantic forms of animals in past times indicate their acme and usually subsequent extinction, in this case, although *Edaphodon* itself is extinct (ranging from Cretaceous to Lower Pliocene) the group of the Chimaeroids is now represented by much smaller species (*Chimaera* and *Callorhynchus*).

In making comparisons between the already described *E. sweeti* and the present form we note the following distinctions: (1) *E. mirabilis* is very much thicker and heavier; (2) the prolongation of the maxilla is twice as great as in *E. sweeti*; (3) the tritors in *E. mirabilis* are also longer than in *E. sweeti*, the posterior internal in the latter being subtrigonal in form as against the obovate form in *E. mirabilis*; the internal anterior and the external tritors in *E. sweeti* appear to be of similar dimensions, but in *E. mirabilis* the internal anterior is the larger.

From the fact that the matrix seen in the cavities of the fossil is exactly of the Beaumaris character, that is, a fine cemented ferruginous sand, whilst Cambridge Greensand specimens are generally embedded in a pale to green calcareous glauconitic marl, it is, without doubt, an indigenous specimen and not, as might be suspected by some, to have been "derived" in a non-geological sense.

Occurrence.—Kalimnan. From the shingle bed, derived from the basal portion of the series at Beaumaris. Nat. Mus. Coll., collected and presented by Mr. H. J. Prentice.

Genus **Ischyodus**, Egerton.

Ischyodus mortoni, Chapman and Pritchard.

Ischyodus mortoni, Chapman and Pritchard, 1907, Proc. Roy. Soc. Vict., vol. XX. (N.S.), pt. I., p. 63, pl. VI., fig. 6.

Observations.—No further record of this species has been made.

1.—E. T. Newton, 1878, pt. 4, p. 21, pl. vii.

Family LABRIDAE.

Genus **Labrodon**, Gervais. (Wrasses.)

LABRODON BATESFORDIENSIS, sp. nov.

(Plate XI., figs. 41, 42.)

Description.—Lower pharyngeal widely crescentic, with two distinct and prominent rows of rounded or button-shaped teeth, with a clear space between. The extreme margins of the pharyngeal salient, curving outward from the upper part of the lower jaw. Teeth of the forward edge inclined to be wedge-shaped at apex. Surface of teeth covered with a fine, rugosely sculptured enamel cap, of a warm brown colour. The remainder of the pharyngeal consists of a grey ossified substance. Successional teeth are seen on the inner side of the pharyngeal, but not exposed.

Dimensions.—Holotype (lower pharyngeal): width of jaw (incomplete), 26mm.; height, 17mm.; average diameter of teeth, 3.5mm.

Observations.—In its general shape the above species somewhat resembles that of a *Labrus*, but the two effective series of teeth precludes that reference. It must therefore be recorded as a species of *Labrodon*. The absence of angularity in the pharyngeal makes it distinct from the genus *Nummopalatus*, and it differs from *Labrodon confertidens* in the sparsely scattered dentition.

Occurrence.—Janjukian. Batesford (Nat. Mus. Coll., collected by Mr. E. O. Cudmore, pres. by F. A. Cudmore).

LABRODON CONFERTIDENS, Chapman and Pritchard.

Trygon ensifer, Davis (pars), 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 37, pl. VI., figs. 14, 15.

Labrodon confertidens, Chapman and Pritchard, 1907, Proc. Roy. Soc. Vict., vol. XX. (N.S.), pt. 1, p. 65, pl. V., fig. 7. Chapman, 1914, Australasian Fossils, p. 271, fig. 131*e*. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 27, pl. IX., fig. 14.

Observations.—*L. confertidens* appears to be a rare species since the only additional specimen coming under our notice is that found on the beach at Portland. It is a worn fragment representing half an upper pharyngeal plate. In this specimen there are about six layers of successional teeth which precludes its reference to *Labrus*.

Additional Occurrence.—Beach at Portland (T. S. Hall Coll., pres. to the Nat. Museum by F. A. Cudmore). ? Janjukian.

Genus **Nummopalatus**, Rouault. (Wrasses.)

NUMMOPALATUS DEPRESSUS, Chapman and Pritchard sp.

(Plate XI., fig. 43.)

Trygon ensifer, Davis (pars), 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 37, pl. VI., figs. 13, 13*a*, 13*b*.

Labrodon depressus, Chapman and Pritchard, 1907, Proc. Roy. Soc. Vict., vol. XX. (N.S.), pt. 1, p. 66, pl. V., figs. 8, 9. Chapman, 1914, Australasian Fossils, p. 271. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 27, pl. VI., figs. 13, 13*a*, 13*b*.

Observations.—We have separated this species from *Labrodon* on account of the discovery of more perfect specimens, which show the pharyngeals to be more or less triangular in form. This species appears to be fairly abundant. It is characteristic of the base of the Kalimnan in Victoria. In New Zealand it occurred in the Miocene of Coleridge Gully, Trelissick Basin. In all probability the isolated teeth found in the Mallee Bores (recorded as ? *Chrysophrys*) belong to this species. They came from Bore 3, 201-220ft., and Bore 8, 210-219ft.

Additional Occurrence.—Two specimens from Grange Burn, near Hamilton, Victoria, were presented to the Nat. Museum by Mr. S. F. Mann, one of which is here figured. Additional specimens from Beaumaris have been presented to the Nat. Museum by Mr. B. Ochiltree and Mr. H. J. Prentice. Kalimnan.

Family SPARIDAE.

Genus **Sargus**, Cuvier. (Sea-breams.)

SARGUS LATICONUS, Davis.

Sargus laticonus, Davis, 1888, Trans. Roy. Dubl. Soc., ser. 2, vol. IV., p. 43, pl. VII., figs. 3-8. Chapman, 1917, Proc. Roy. Soc. Vict., vol. XXIX. (N.S.), pt. 2, p. 140, pl. IX., fig. 9. Idem, 1918, N.Z. Geol. Surv., Pal. Bull. No. 7, p. 28, pl. VII., figs. 3-7.

Observations.—There has been no further record of this species but some of the peg-like teeth mentioned in the succeeding description may eventually be referred here.

Genus **Pagrosomus**, Gill, 1893. (Schnapper.)

PAGROSOMUS AURATUS, Forster sp.

Sciaena aurata, Forster, in Bloch and Schneider, Ichth., 1801, p. 266.

Chrysophrys unicolor, Quoy and Gaim., Voy. Uran. and Physic., 1824, p. 299.

Pagrus unicolor, Cuv. and Val. Hist. Nat. Poiss., 1824, vol. VI., p. 162. Ten. Woods, 1883, Fish. N.S.W., p. 39, pl. VIII. and frontispiece. Ogil., 1893, Edib. Fish. N.S.W., p. 47, pl. XIII.

Pagrus guttulatus and *P. micropterus*, Cuv. and Val., Hist. Nat. Poiss., 1830, p. 160, 163.

Pagrus latus, Rich., Rep. Brit. Ass., 1842, p. 209.

Chrysophrys gibbiceps, Canestrini, 1869, Arch. Zool. Anat. (2), vol. I., p. 154.

Pagrosomus (and Sparosomus) auratus, Gill, Nat. Acad. Sci., vol. VI., 1893, p. 97, 116, 123. Stead, 1908, Edib. Fish. N.S.W., p. 75, pl. XLII. (young). Waite, 1921, Rec. S. Aus. Mus., vol. II., No. 1, p. 198, fig. 166.

Observations.—Remains of the schnapper are quite common in the Pleistocene deposits round Melbourne. The chief portions generally collected consist of the cranium with its huge supra-occipital and occasionally some vertebral remains. No teeth appear to have been yet collected from these deposits, but some either referrable to this or to the Groper (*Aecherodus*) are found in the Kalimnan beds at Beaumaris and these are awaiting further determination.

Occurrence.—Pleistocene. 14 feet from the surface, Cole's Dock Excavations, Flinders Street (Nat. Mus. Coll., pres. by the Hon. A. F. Greeves, M.L.A.) West Melbourne Swamp (Nat. Mus. Coll., pres. by the Dept. of Mines), 13 feet below high water mark, Church Street Bridge Excavations; frontal and parietal bones, also vertebrae (Nat. Mus. Coll., pres. by Mr. A. Lynch).

Family OPLEGNATHIDAE.

Genus **Oplegnathus**, Richardson, 1840. (Knife-Jaw.)

Oplegnathus manni, sp. nov.

(Plate XI., fig. 44, 45.)

Description.—Holotype. Lower right pharyngeal. Triangular; the symphysial edge vertical, straight; cutting edge sloping to the back with a slight inward curvature; base thick. Internally concave. This pharyngeal bone is composed of a fasciculated mass of fused, vertically elongated teeth which are exposed at the cutting edge in one continuous row of wedge-shaped enamel caps; beneath these on the external face is another shorter series below which they die out or are covered by the bone of the pharyngeal. Internally the pharyngeal shows the exposed surfaces of the elongated teeth, which appear to grow upward as the cutting edge is worn down. On the basal proximal part of the pharyngeal the small grinding teeth reappear on the exterior in two or three rows.

Dimensions.—Width of basal part of pharyngeal (imperfect), 21mm.; greatest thickness at base, 9mm.; vertical height of pharyngeal, measured along the symphysial surface, 23mm.; greatest depth of exposed teeth on the external surface, 5mm.; average diameter of teeth, 1.5mm.

Comparison.—Through the kind offices of Mr. J. A. Kershaw, F. E. S., Curator of the National Museum, who has made a special study of the Australian living fish faunas, we are enabled to refer this fossil without doubt to the genus *Oplegnathus*. Its occurrence in Australian waters is fully explained in Mr. Kershaw's note which

is here appended and in which he records it from an entirely new locality:—

The genus *Oplegnathus* is represented in Australia by one living species, *O. woodwardi*, Waite, which has been previously recorded from Western and South Australia.

It is interesting, in view of the occurrence in the Kalimnan beds at Grange Burn, Victoria, of a very closely allied species, to record a recent specimen of *O. woodwardi* from Queenscliff, Victoria, obtained in September, 1877, by the late Rev. Dr. J. I. Bleasdale.

The specimen, which is mounted and exhibited in the Australian Fish Gallery is in excellent condition, and compares favorably with Waite's original description and figure.*

Occurrence.—Kalimnan. Grange Burn, Victoria (Nat. Mus. Coll., pres. by Mr. S. F. Mann).

Family SPHYRAENIDAE.

Genus **Sphyraena**, Bloch and Schn. (Snook or Short-finned Pike.)

SPHYRAENA NOVAE-HOLLANDIAE, Günther.

Sphyraena novae-hollandiae, Günther, Waite, 1900, Rec. Aus. Mus., p. 210. Waite, 1921, Fishes S. Aus., Rec. S. Aus. Mus., vol. II., No. 1, p. 85, fig. 128.

Observations.—One example of the cranium of this species was found in the West Melbourne Swamp.

Occurrence.—Pleistocene. West Melbourne Swamp (Nat. Mus. Coll., pres. by Mr. Bromfield).

Family GYMNODONTIDAE.

Genus **Diodon**, Linné. (Porcupine Fish.)

DIODON FORMOSUS, Chapman and Pritchard.

Diodon formosus, Chapman and Pritchard, 1907, Proc. Roy. Soc. Vict., vol. XX. (N.S.), pt. 1, p. 66, pl. VI., figs. 1-3; pl. VII.; pl. VIII., figs. 1-7. Chapman, 1914, Australasian Fossils, p. 270, 271, fig. 131*f*. Idem, 1916, Rec. Geol. Surv. Vict., vol. III., pt. 4, p. 343, 379.

Observations.—This species is here recorded from the Janjukian for the first time. The specimen from Curlewis probably represents the lower jaw; only the palatal portion, showing ten plates, is left.

A fine upper jaw from Grange Burn was presented by Mr. W. Greed; it gives the following measurements:

Dimensions.—Lateral width, 65mm.; base to front, 47mm.; width of palate, 33.5mm.; depth of palate, 34.5mm.; number of plates: only six visible.

Additional Occurrence.—? Janjukian. In the shingle at Balcombe Bay (Nat. Mus. Coll., pres. by F. A. Cudmore). Janjukian. Curlewis (Nat. Mus. Coll., pres. by Mr. A. Curlewis). At the top of the Janjukian in the Mallee Bores (Bore 5, 175-189ft.); Nat. Mus. Coll.

* Rec. Aust. Mus., III., 1900, p. 212, pl. xxxvii.

DIODON CONNEWARRENSIS, Chapman and Pritchard.

Diodon connewarrensis, Chapman and Pritchard, 1907, Proc. Roy. Soc. Vict., vol XX. (N.S.), pt. 1, p. 69, pl. VIII., figs. 8-10.

Observations.—There has been no further record of this species.

Family OSTRACIONTIDAE.

Genus **Aracana**, Gray, 1838. (Cow-fish.)

ARACANA KERSHAWI, sp. nov.

(Plate XI., fig. 46.)

Description.—Holotype. Dermal spine, probably from the dorsal carina. Triangular, strongly compressed, recurved towards the apex, base expanded; surface with few strong ridges which occasionally coalesce and bifurcate towards the base.

Dimensions.—Height, 17mm.; width at base, 11.5mm.; width at middle, 7mm.

Comparisons.—The species, *Aracana aurita*, Shaw[12], which is found in Victorian waters has a more delicately structured spine, being smaller, more backwardly recurved and with the edges twice as fine. We are indebted to Mr. J. A. Kershaw, F.E.S., Curator of the National Museum, for the generic determination of this interesting fossil, and we have much pleasure in naming the new species after him.

Observations.—This appears to be the first recorded occurrence of the genus in fossil deposits. As regards fossil representatives of the family, a well preserved fish from the Upper Eocene of Monte Bolca is figured by Agassiz[13] under the name *Ostracion micrurus*; but this does not seem related to the Australian members of the family since it shows a prominent dorsal fin.

Occurrence.—Janjukian. Lower bed, Table Cape, Tasmania (Nat. Mus. Coll., pres. by F. A. Cudmore).

Acknowledgments and Note.

We desire to thank Mr. J. A. Kershaw, F.E.S. Curator of the National Museum, for his valuable aid in comparing some of the fossil forms with those of the living fishes.

To Mr. F. A. Singleton, M.Sc., of the Melbourne University, we are under obligations for the opportunity of describing the holotype of *Cestracion longidens*, which he has now presented to the National Museum.

12.—*Ostracion aurita*, Shaw, 1798, Nat. Misc., vol. ix., pl. cccxxxviii., Idem, 1804, Gen. Zool., vol. v., p. 429, pl. clxxiii.
Aracana aurita, Shaw, sp.; Waite, 1921, Rec. S. Aust. Mus., vol. ii., No. 1, p. 193, 322.

13.—Poiss. Foss., vol. ii., 1833-44, pt. 1, p. 17; pt. 2, p. 263, pl. lxxiv.

The enthusiastic collecting of one of our younger geological workers, Mr. H. J. Prentice, has enabled us to deal with two interesting forms, *Myliobatis prenticei* and *Edaphodon mirabilis*.

Mr. J. E. Dixon has placed us under further obligation by submitting to us several interesting specimens from his fossil collection.

Miss Irene Crespin, B.A., has kindly allowed us to include her recent discovery of a tooth of *Isurus retroflexus* at Green Gully.

Since the T. S. Hall Collection is frequently referred to, we must state that this is included in the Cudmore private collection.

FAMILIES.	SPECIES.	RANGE.	LOCALITIES.
	Order PLAGIOSTOMI, *Duméril.*		
Notidanidae	*Notidanus jenningsi*, Ch. & Pr.	Kalimnan	Beaumaris.
Spinacidae	*Acanthias geelongensis*, Ch. & Pr.	Janjukian	Bird Rock Cliffs. Orphanage Hill.
Cestraciontidae	*Cestracion cainozoicus*, Ch. & Pr.	Janj. to Kal	Bird Rock Cliffs. Upper and lower beds, Table Cape. Murgheboluc. Warranooke. Grange Burn. Beaumaris.
,,	,, *coleridgensis*, Chapman	Janj. to Kal.	Table Cape (Upper and Lower). Beaumaris.
,,	,, *novo-zelandicus*, Chapman	Janj. to Kal.	Mallee Bores. Beaumaris.
,,	,, *longidens*, sp. nov.	Janj. to Kal.	Curlewis. Beaumaris.
,,	*Strophodus cocenicus*, Tate	Janj. to Kal.	Table Cape (Upper and Lower). Moorabool River. Beaumaris.
Carchariidae	*Hemipristis serra*, Ag.	Janjukian	Murray River Cliffs, S.A.
,,	*Galeocerdo davisi*, Ch. & Pr.	Janj. to Kal.	Gellibrand Coast Sections. South Yarra. Beaumaris. Grange Burn.
,,	,, *latidens*, Agassiz	Kalimnan	Grange Burn. Beaumaris.
,,	,, *aduncus*, Agassiz	Janj. to Kal.	Mallee Bores. Beaumaris.
,,	*Carcharias collata*, Eastman	Kalimnan	Beaumaris.
,,	,, *victoriae*, sp. nov.	Janj. to Kal.	Table Cape (Upp.). Beaumaris.
,,	,, (*Prionodon*) *aculeatus*, Davis sp.	Bale. to Kal.	Clifton Bank, Muddy Creek. Grice's Creek. Mallee Bores. Neumerella. Beaumaris.

Distribution of Species—*continued.*

FAMILIES.	SPECIES.	RANGE.	LOCALITIES.
Carchariidae	,, (,,) *incidens*, Eastman	Janjukian	Red Hill, Shelford.
,,	,, (,,) *javanus*, Martin	Balcombian	Clifton Bank, Muddy Creek.
,,	*Carcharoides totuserratus*, Ameghino	Janjukian	Waurn Ponds. West of Rocky Point, Torquay. Batesford.
,,	,, *tenuidens*, Chapman	Janjukian	Waurn Ponds.
,,	*Sphyrna prisca*, Agassiz	Balc. to Janj.	Clifton Bank, Muddy Creek. Batesford. Orphanage Hill.
Lamnidae	*Odontaspis contortidens*, Agassiz	Balc. to Upper Pliocene	Balcombe Bay. Grice's Creek. Muddy Creek (Low.). Bird Rock Cliffs. Batesford. Waurn Ponds. Fyansford. Moorabool Valley. Belmont. Bet. Pt. Addis and Anglesea. Coast Section, Castle Cove. Aire River. Beach, Rivernooke. Neumerella. Aldinga (Low.). Grange Burn. Beaumaris. Limestone Creek.
,,	,, *incurva*, Davis sp.	Janj. to Kal.	Waurn Ponds. Batesford. Clyde, near Geelong. Warranooke. Neumerella. Morgan, S.A. Grange Burn. Beaumaris.
,,	,, *elegans*, Agassiz sp.	Janjukian	Waurn Ponds. Batesford. Red Hill, Shelford. Fyansford. ? Bird Rock Cliffs. Mt. Gambier, S.A.
,,	,, *attenuata*, Davis sp.	Janj. to Kal.	Waurn Ponds. Batesford. Belmont. Bird Rock Cliffs. Aldinga (Low.), Beaumaris,

Distribution of Species—*continued.*

FAMILIES.	SPECIES.	RANGE.	LOCAILTIES.
Lamnidae	,, *cuspidata*, Agassiz sp.	Janj. to Kal.	Cape Otway. East of Gellibrand River. Table Cape (Upp.). Grange Burn. Beaumaris.
,,	,, *rutoti*, Winkler sp.	Janjukian	Lower bed, Table Cape.
,,	*Lamna apiculata*, Agassiz sp.	Balc. to Kal.	Balcombe Bay. Muddy Creek (Low.). Bird Rock Cliffs. Danger Pt., Torquay. Moorabool River. Batesford. Meredith. Waurn Ponds. Nine miles west of Casterton. Gellibrand Coast Section. Table Cape (Low.). Morgan and four miles below Morgan. Mt. Gambier. Aldinga (Low.). Grange Burn. Beaumaris.
,,	,, *compressa*, Agassiz	Janj. to Kal.	Batesford. Mallee Bores. Warranooke. Croydon Bore, S. Aus. Table Cape. Beaumaris. Grange Burn.
,,	,, *crassidens*, Agassiz	Balc. to Kalimnan	Balcombe Bay. Muddy Creek (Low.). Bird Rock Cliffs. Waurn Ponds. Morgan. Beaumaris.
,,	,, *bronni*, Agassiz	Janjukian	Waurn Ponds.
,,	*Isurus hastalis*, Agassiz sp.	Balc. to Kal.	Balcombe Bay. Muddy Creek (Low.). Grice' Creek. Coast south of Grice's Creek. Moorabool River. Murgheboluc. Bullenmerri. L. Keilambete. South Yarra. Leigh River, Shelford. Mitchell River, Bairnsdale. Four miles below Morgan. Beaumaris. Grange Burn. Black Rock.

Distribution of Species—*continued.*

FAMILIES.	SPECIES.	RANGE.	LOCALITIES.
Lamnidae -	,, *retroflexus*, Agassiz sp. -	Janj. to Kal. -	Bird Rock Cliffs. Waurn Ponds. Batesford. Rutledge's. Moorabool River. Curlewis. West of Gellibrand River. Nine Miles west of Casterton. Morgan and four miles below Morgan. Table Cape (Low.). Grange Burn. Beaumaris.
,, -	,, *eocaenus*. A. S. Woodward sp. -	Janj. to Kal. -	Curlewis. Four Miles below Morgan. Grange Burn. Beaumaris.
,, -	,, *minutus*, Agassiz sp. -	Balc. to Janj. -	Muddy Creek (Low.). Bird Rock Cliffs. Batesford. Table Cape (Upp.). Waurn Ponds. Belmont. East of Gellibrand River. Grange Burn. Beaumaris.
,, -	,, *desorii*, Agassiz sp. -	Janj. to Kal. -	Bird Rock Cliffs. Waurn Ponds. Clyde. Kawarren. Birregurra. Grange Burn. Beaumaris.
,, -	*Carcharodon megalodon*, Charlesworth -	Balc. to Kal. -	Muddy Creek (Low.). Bird Rock Cliffs. Grange Burn lower limestones. Waurn Ponds. Batesford. Native Hut Creek. Neumerella. Table Cape (? Low.). Grange Burn. Beaumaris.
,, -	,, *auriculatus*, Blainville -	Janj. to Kal. -	Waurn Ponds. Bird Rock Cliffs. Rocky Pt., Spring Creek. Casterton. Table Cape (Low.). Nine miles west of Casterton. Grange Burn. Beaumaris.

Distribution of Species—*continued.*

FAMILIES.	SPECIES.	RANGE.	LOCALITIES.
Lamnidae	,, *carcharias*, Linné	Kal. to Pleistocene (also living)	Grange Burn. Beaumaris. West Melbourne Swamp. Between Cowie's and Duck Ponds.
Squatinidae	*Squatina gippslandicus*, sp. nov.	Janjukian	Neumerella.
Pristiophoridae	*Pristiophorus lanceolatus*. Davis sp.	Janj. to Kal.	Batesford. Macdonald's, Muddy Creek. Beaumaris.
Pristidae	*Pristis cudmorei*, Chapman	Kalimnan	Beaumaris.
,,	,, *recurvidens*, sp. nov.	Janj. to Kal.	Murray River Cliffs. Table Cape (Upp.) Beaumaris.
Trygonidae	*Trygon* cf. *rugosus*, Probst sp.	Janjukian	Mallee Bores.
Myliobatidae	*Myliobatis moorabbinensis*, Chap. & Prit.	Kalimnan	Beaumaris.
,,	,, *affinis*, sp. nov.	Janj. to Kal.	Bird Rock Cliffs. Table Cape (Upp.). Mallee Bores (Janj. to Kal.). Beaumaris.
,,	,, *prenticei*, sp. nov.	Janjukian	Waurn Ponds.
,,	,, *tenuicaudatus*, Hector	Pleistocene to Holocene (also living)	West Melbourne Swamp. Williamstown.
	Order HOLOCEPHALI.		
Chimaeridae	*Edaphodon sweeti*, Chap. & Prit.	Kalimnan	Grange Burn. Beaumaris. Black Rock.
,,	,, *mirabilis*, sp. nov.	Kalimnan	Beaumaris.
,,	*Ischyodus mortoni*. Chap. & Prit.	Janjukian	Table Cape (Upper bed).

Distribution of Species—*continued.*

FAMILIES.	SPECIES.	RANGE.	LOCALITIES.
	Order PHYSOCLYSTI.		
Labridae	*Labrodon confertidens*, Chap. & Prit.	Kal. (&? Janj.)	Portland Beach (? Janj.). Grange Burn
,,	,, *batesfordiensis*, sp. nov.	Janjukian	Batesford.
,,	*Nummopalatus depressus*, Chap. & Prit. sp.	Kalimnan	Grange Burn. Beaumaris.
Sparidae	*Sargus laticonus*, Davis	Janjukian	Batesford.
,,	*Pagrosomus auratus*, Forster sp.	Pleistocene (also living)	West Melbourne Swamp. Church St. Bridge. Flinders St.
Oplegnathidae	*Oplegnathus manni*, sp. nov.	Kalimnan	Grange Burn.
Sphyraenidae	*Sphyraena novae-hollandiae*, Günther	Pleistocene (also living)	West Melbourne Swamp.
Gymnodontidae	*Diodon formosus*, Chap. & Prit.	Janj. to Kal.	Curlewis. Mallee Bores. Balcombe Bay (? Janj.). Grange Burn. Beaumaris.
,,	,, *connewarrensis*, Chap. & Prit.	Janjukian	Lake Connewarre.
Ostraciontidae	*Aracana kershawi*, sp. nov.	Janjukian	Lower bed, Table Cape.

Chronological List of Species.

The following species is restricted to the Balcombian:

Carcharias (Prionodon) javanus, Martin.

The following species ranges from the Balcombian to the Upper Pliocene:

Odontaspis contortidens, Agassiz.

The following species range from the Balcombian to the Kalimnan:

Carcharias (Prionodon) aculeatus, Davis sp.
Lamna apiculata, Agassiz sp.
Isurus hastalis, Agassiz sp.
Carcharodon megalodon, Charlesworth.
Lamna crassidens, Agassiz.

Two species range from the Balcombian to the Janjukian:

Sphyrna prisca, Agassiz.
Isurus minutus, Agassiz sp.

Sixteen species are restricted to the Janjukian:

Acanthias geelongensis, Chapman and Pritchard.
Hemipristis serra, Agassiz.
Carcharias (Prionodon) incidens, Eastman.
Carcharoides totuserratus, Ameghino.
Carcharoides tenuidens, Chapman.
Odontaspis elegans, Agassiz sp.
Odontaspis rutoti, Winkler sp.
Lamna bronni, Agassiz.
Trygon cf. *rugosus*, Probst sp.
Myliobatis prenticei, sp. nov.
Ischyodus mortoni, Chapman and Pritchard.
Labrodon batesfordiensis, sp. nov.
Sargus laticonus, Davis.
Diodon connewarrensis, Chapman and Pritchard.
Aracana kershawi, sp. nov.
Squatina gippslandica, sp. nov.

Twenty species range from the Janjukian to the Kalimnan:

Cestracion cainozoicus, Chapman and Pritchard.
Cestracion coleridgensis, Chapman.
Cestracion novo-zelandicus, Chapman.
Cestracion longidens, sp. nov.
Strophodus eocenicus, Tate.
Galeocerdo davisi, Chapman and Pritchard.
Galeocerdo aduncus, Agassiz.
Carcharias victoriae, sp. nov.
Odontaspis incurva, Davis sp.
Odontaspis attenuata, Davis sp.
Odontaspis cuspidata, Agassiz sp.
Isurus retroflexus, Agassiz sp.

Isurus eocaenus, A. S. Woodward sp.
Isurus desorii, Agassiz sp.
Carcharodon auriculatus, Blainville.
Pristiophorus lanceolatus, Davis sp.
Pristis recurvidens, sp. nov.
Myliobatis affinis, sp. nov.
Diodon formosus, Chapman and Pritchard.
Labrodon confertidens, Chapman and Pritchard.

One species ranges from the Janjukian to the Upper Pliocene:
Lamna compressa, Agassiz.

Nine species are restricted to the Kalimnan:
Notidanus jenningsi, Chapman and Pritchard.
Galeocerdo latidens, Agassiz.
Carcharias collata, Eastman.
Pristis cudmorei, Chapman.
Myliobatis moorabbinensis, Chapman and Pritchard.
Edaphodon mirabilis, sp. nov.
Edaphodon sweeti, Chapman and Pritchard.
Nummopalatus depressus, Chapman and Pritchard.
Oplegnathus manni, sp. nov.

One species ranges from the Kalimnan to the Pleistocene and is living still in Australian seas:
Carcharodon carcharias, Linné sp.

Three species occur in the Pleistocene and are still living in Australian seas:
Myliobatis tenuicaudatus. Hector. (also in Holocene.)
Pagrosomus auratus, Forster sp.
Sphyraena novae-hollandiae. Günther.

With regard to the Kalimnan occurrences it is probable that some of the fossils have been derived from the older beds.

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EXPLANATION OF PLATES.

Plate IX.

Fig. 1.—*Acanthias geelongensis*, Chapman and Pritchard. Internal face. Janjukian. From the "Ledge," Bird Rock Cliffs, Torquay. Pres. F. A. Cudmore.

,, 2.—*Cestracion cainozoicus*, Chapman and Pritchard. Specimen showing vermiculate pitting. Kalimnan. Beaumaris. Pres. F. A. Cudmore.

,, 3.—*Cestracion cainozoicus*, Chapman and Pritchard. A gerontic form. Kalimnan. Beaumaris. Pres. H. Mathias.

,, 4, 5, 6, 7.—*Cestracion cainozoicus*, Chapman and Pritchard. Teeth of the anterior series. Kalimnan. Beaumaris. Pres. F. A. Cudmore.

,, 8.—*Cestracion coleridgensis*, Chapman. Large specimen. Janjukian. Lower bed, Table Cape. Pres. F. A. Cudmore.

,, 9.—*Cestracion novo-zelandicus*, Chapman. Kalimnan. Beaumaris. Pres. F. A. Cudmore.

,, 10.—*Cestracion longidens*, sp. nov. Holotype. Kalimnan. Beaumaris. Pres. F. A. Singleton.

,, 11.—*Strophodus eocenicus*, Tate. Janjukian. Lower bed, Table Cape. Pres. F. A. Cudmore.

,, 12.—*Hemipristis serra*, Agassiz. External face. Janjukian. Murray River Cliffs. Pres. F. A. Cudmore.

Fig. 14.—*Carcharias collata*, Eastman. External face. Kalimnan. Beaumaris. Pres. F. A. Cudmore.

„ 13, 15, 16.—*Carcharias collata*, Eastman. Internal face of three specimens. Kalimnan. Beaumaris. Pres. F. A. Cudmore.

„ 17.—*Carcharias victoriae*, sp. nov. Co-type. Internal face of tooth from upper jaw. Janjukian. Upper bed, Table Cape. Pres. F. A. Cudmore.

„ 18.—*Carcharias victoriae*, sp. nov. Co-type. Internal face of tooth from lower jaw. Kalimnan. Beaumaris. Pres. F. A. Cudmore.

„ 19.—*Carcharias* (*Prionodon*) *aculeatus*, Davis sp. Internal face. Janjukian. Neumerella. Coll. F. Chapman.

„ 20.—*Carcharias* (*Prionodon*) *aculeatus*, Davis sp. Internal face. Kalimnan. Beaumaris. Coll. H. Mathias.

„ 21.—*Carcharias* (*Prionodon*) *incidens*, Eastman. Internal face. Janjukian. Red Hill, Shelford. Pres. J. H. Young.

„ 22.—*Carcharias* (*Prionodon*) *javanus*, Martin. Internal face. Balcombian. Clifton Bank, Muddy Creek. Pres. F. A. Cudmore.

„ 23.—*Sphyrna prisca, Agassiz.* Internal face. Balcombian. Clifton Bank, Muddy Creek. Pres. F. A. Cudmore.

„ 24.—*Odontaspis contortidens*, Agassiz. Internal face. Kalimnan. Grange Burn, near Hamilton. Pres. S. F. Mann.

Plate X.

Fig. 25.—*Odontaspis cuspidata*, Agassiz sp. External face of anterior tooth. Upper bed, Table Cape. Pres. F. A. Cudmore.

„ 26.—*Odontaspis cuspidata*, Agassiz sp. External face of immature tooth. Upper bed, Table Cape. Pres. F. A. Cudmore.

„ 27.—*Odontaspis rutoti*, Winkler sp. Internal face. Janjukian. Lower bed, Table Cape. Pres. F. A. Cudmore.

„ 28.—*Lamna apiculata*, Agassiz. Internal face. Kalimnan. Beaumaris. Pres. F. A. Cudmore.

„ 29.—*Lamna apiculata*, Agassiz. Internal face showing one of two denticles. Janjukian. Lower bed, Aldinga. Pres. F. A. Cudmore.

„ 30.—*Isurus hastalis*, Agassiz sp. Internal face. Janjukian. Section IVa, Murgheboluc. Pres. F. A. Cudmore.

„ 31.—*Isurus retroflexus*, Agassiz sp. External face. Janjukian. Morgan. Pres. F. A. Cudmore.

„ 32.—*Isurus desorii*, Agassiz sp. Internal face. Janjukian. Bird Rock Cliffs, Torquay. Pres. F. A. Cudmore.

„ 33.—*Pristiophorus lanceolatus*, Davis sp. Profile view of oral tooth. Kalimnan. Beaumaris. Pres. F. A. Cudmore.

„ 34.—*Pristis recurvidens*, sp. nov. Holotype. Janjukian. Upper bed, Table Cape. Pres. F. A. Cudmore.

„ 35.—*Pristis recurvidens*, sp. nov. Paratype. Janjukian. Lower Cape. Pres. F. A. Cudmore.

Fig. 36.—*Myliobatis affinis*, sp. nov. Paratype. Lower or articulated surface of median tooth. Janjukian. Upper bed, Table Cape. Pres. F. A. Cudmore.

,, 37.—*Myliobatis prenticei*, sp. nov. Holotype. Dorsal surface of caudal spine. Janjukian. Waurn Ponds. Pres. H. J. Prentice.

PLATE XI.

Fig. 38.—*Edaphodon sweeti*, Chapman and Pritchard. Upper surface of premaxilla. Kalimnan. Black Rock. Pres. Miss Hilda Neal.

,, 39.—*Edaphodon sweeti*. Chapman and Pritchard. Lower surface of right palatine. Kalimnan. Grange Burn. Pres. S. F. Mann.

,, 40.—*Edaphodon mirabilis*, sp. nov. Holotype. Tritorial surface of maxilla. Kalimnan. Beaumaris. Pres. H. J. Prentice.

,, 41.—*Labrodon batesfordiensis*, sp. nov. Holotype. Upper surface of lower pharyngeal. Janjukian. Batesford. Pres. F. A. Cudmore.

,, 42.—*Labrodon batesfordiensis*, sp. nov. Holotype. Weathered surface of interior of lower pharyngeal. Janjukian. Pres. F. A. Cudmore.

,, 43.—*Nummopalatus depressus*, Chapman and Pritchard sp. Kalimnan. Grange Burn. Pres. S. F. Mann.

,, 44.—*Oplegnathus manni*, sp. nov. Holotype. External view of lower right pharyngeal. Kalimnan. Grange Burn. Pres. S. F. Mann.

,, 45.—*Oplegnathus manni*, sp. nov. Holotype. Internal view of lower right pharyngeal. Kalimnan. Grange Burn. Pres. S. F. Mann.

,, 46.—*Aracana kershawi*, sp. nov. Holotype. Profile view of dermal spine. Janjukian. Lower bed, Table Cape. Pres. F. A. Cudmore.

,, 47.—*Squatina gippslandica*, sp. nov. External view of holotype. Janjukian. Neumerella. Collected F. Chapman.